THE MARINE REVIEW

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THE ZOELLY TURBINE

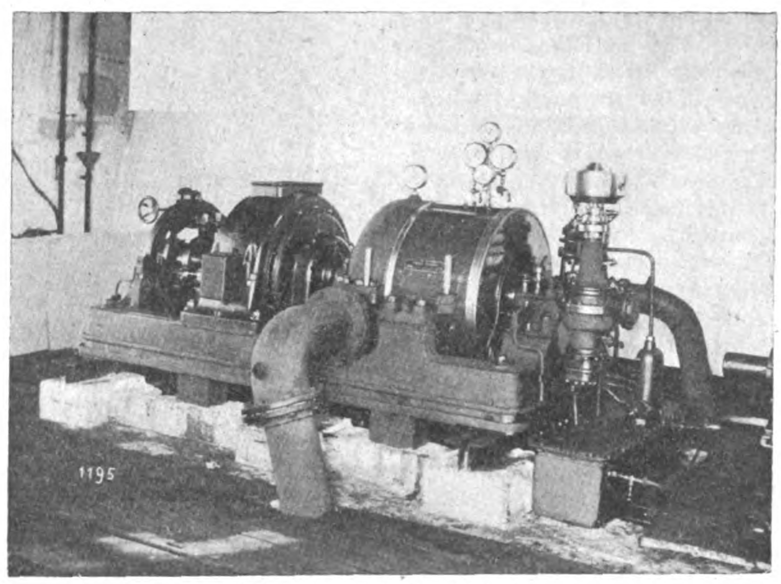
Turbines may be conveniently classed under two types—impulse and reaction. If the former, the steam is expanded in the guides or nozzles only, where the whole of the potential energy in the steam is transformed into kinetic energy. Through successive stages from full inlet pressure to atmospheric pressure or vacuum. The pressure of the steam undergoes no alteration within the revolving position of the turbine, and herein lies one of the chief advantages of the impulse over the reaction turbine, since in the former the clearance between the rotating and stationary elements may be made amply large, thus avoiding any possibility of striking, without, however, in the least diminishing the efficiency of the machine.

In reaction turbines on the contrary in which partial expansion of the steam occurs in the rotating element a difference of pressure exists on the two sides thereof, which not only occasions a serious end or axial pressure on the turbine spindle, but also necessitates such extremely fine clearances between the rotating and stationary elements as to introduce an appreciable source of danger from striking or "stripping" of the blades.

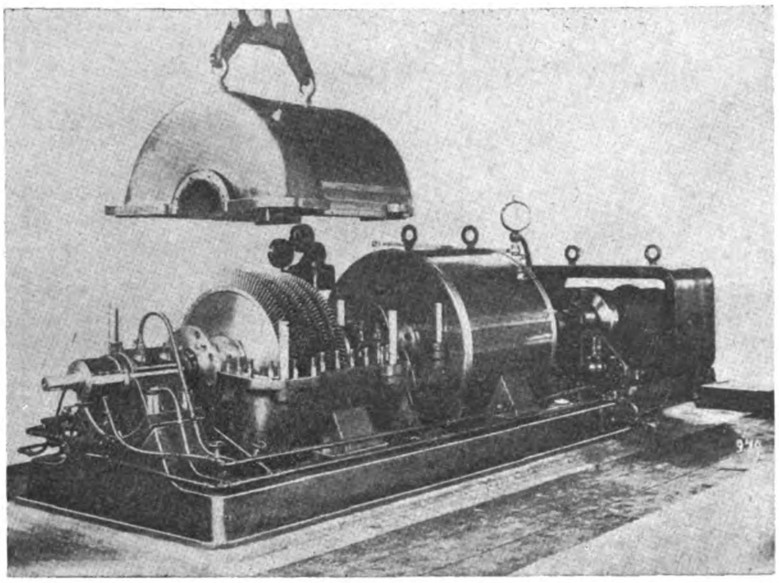
When steam is expanded from 155-lbs. pressure to 1½-lbs. pressure absolute, the velocity of flow corresponding to the change of potential into kinetic energy is approximately 3,600 ft. per second. In order to obtain the best results, the peripheral velocity of the wheels in reaction turbines should be, roughly speaking, two-thirds; but in impulse turbines only approximately one-half of the theoretical steam velocity. Single wheels capable of withstanding the enormous strains due to such speeds are beyond the capacity of any known material, but by employing multiple stages the flow of steam can be so subdivided as to permit of safe running with ordinary constructive materials and suitable design. Obviously the lower speeds required for impulse wheels is a great advantage, since fewer stages have to be arranged for the total drop than is the case in the reaction type.

The Zoelly turbine is a multi-stage impulse turbine, and its chief feature lies in the construction of the wheels, which permits of a relatively small number being used, owing to their ability to withstand the strains due to high rotational speeds. The Zoelly turbine is generally constructed with two casings, a high and a low pressure, in each of which are placed about five complete elements.

Steam is introduced into the first set of guides in which it expands in a five-chambered casing to approximately four-fifths of its initial pressure and acts directly on the first wheel with a velocity corresponding to this drop; from thence it passes to the second guide and wheel, undergoing a further drop, and thus through the series. The two casings, high and low pressure, are separate and distinct from each other, but fixed on a common bed-plate. They are split along the horizontal center line and the casing feet are placed as directly as possible under the line of division, so that no appreciable distortion takes place in the turbine when fully heated up, as compares with its position when cold. The bearings are fixed on the bed-plate independently of the casings, and are therefore unaffected by the heating of the latter. As a further precaution, they are cooled by water supplied under slight pressure, and are, moreover, lubricated by oil from a pump worked off the turbine shaft. Both oil and water are circulated over and over again, the former being collected and filtered. No internal lubrication is required, as is the case with reciprocating engines. In the usual construction three bearings are provided—one beyond each of the two casings, and

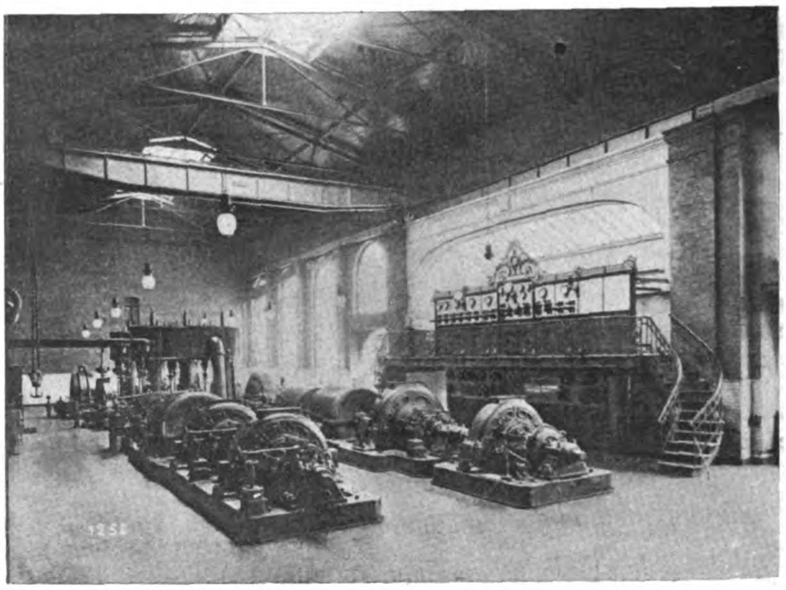


ZOELLY IMPULSE TURBINE ENGINE.



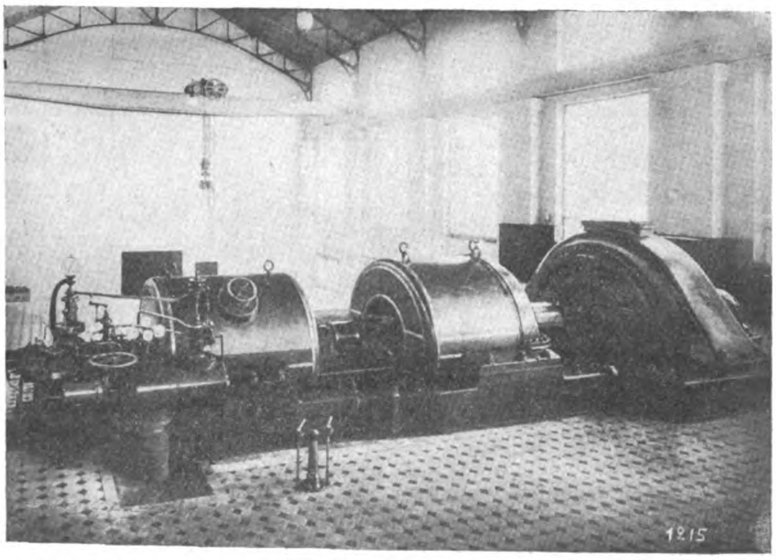
VIEW OF THE ZOELLY TURBINE SHOWING UPPER CASING LIFTED.

one between them. In the smaller sizes the shaft is continuous throughout; but in the larger it is made in two lengths, and coupled between the casings with a double bearing, making five in all. In the smaller sizes the shaft is free to bend, but in the larger, the speed being below the critical for the material, the shaft is rigid. On the shaft are keyed the wheels which are forged in one piece with the boss from high grade open-hearth steel, and are polished all over. The blades of nickel steel are much fewer in number per wheel than in the reaction type; are secured by a special device to the periphery of the wheel, and are separated by distant pieces, the whole being backed by a grooved ring of forged steel riveted to the wheel. The cross section of the blades decreases from the point of attachment towards the tip, with the result that they are well adapted to resist the strains set up by the high peripheral speed at which they run. The blades, like the wheels themselves, are highly polished in order to minimize friction losses, while the nickel steel of which they are constructed enables them to retain their polished surfaces and clean-cut edges over lengthened periods of continuous operation. The outside of the boss of each wheel is turned, and is an easily-running fit in the bore of its guide chamber, the boss of the latter containing several small grooves which trap any escape of steam from one section to the other. Like the casings, the guide chambers are divided along the horizontal center line; the upper portion of the guide is secured to the upper half of the casing, and the lower half in like manner to the lower casing. Owing to this construction it is a very simple operation to lift the whole of the upper part of the casing with the attached halves of the guide chambers clear of the lower part, giving free access to the whole of the internal parts of the turbine.



ZOELLY TURBINE AT TETLOW CANAL STATION.

Appended is a table of results obtained in some tests made in the beginning of 1905 with the plant at the electric power station at Mulhausen, which consists of a 550-brake H. P. Zoelly turbine, directly coupled to two direct-current dynamos. The tabulated results show how nearly uniform was the steam consumption between 350 H. P. and 700 H. P.; that is, between half load and the maximum full load. This is claimed as a special advantage of the Zoelly turbine, since in electricity works, for which steam turbines are particularly suited, very great variations of load occur at short intervals. The extraordinary steady running is also a noteworthy point, the speed not once varying by 3 per cent with a sudden 100 per cent in-



550 BRAKE HORSEPOWER ZOELLY IMPULSE TURBINE AT ELECTRIC STATION, MULHAUSEN.

crease or decrease in the load. The low steam consumption should also be noted, especially in view of the fact that the existing boilers had only a relatively low pressure, viz: 110 lbs. per square inch. Messrs. Mather & Platt, Ltd., Salford Iron Works, Manchester, are the makers and our illustrations are from photographs supplied by Messrs. Escher Nyss & Co., Engineers, of Zurich.

Results of the tests for steam consumption Zoelly turbine:

Date of Test	26-2-05	27-2-05	27-2-05	27-2-05	27-2-05
Useful output kilowatts	132.19	208.21	291.52	391.13	463.22
Useful output B. H. P.	229.34	345.11	459.28	597.77	697.91
Revolutions per minute	3061	3050	3040	3020	3020
Pressure at inlet lbs. per square inch	126.83	124.63	125.07	124.92	125.36
Temperature °c	170.6	170.5	170.4	170.3	170.5
Pressure before 1st guide, lbs. per sq. in.	39.83	55.85	73.48	95.97	111.84
Vacuum per cent	95.3	94.5	93.8	92.7	91.7
Steam consumption per hour, lbs.	4132	5472	7143	9162	10624
Steam consumption per kilowatts per hr. lbs.	31.19	26.28	24.5	23.43	22.9
Steam consumption per B. H. P. per hr. lbs.	17.98	15.86	15.55	15.34	15.22
Thermodynamic efficiency per cent	45.4	51.6	53.4	55.03	56.4

TRIAL OF AN AIR-LIFT PUMP.

(From *Engineering*.)

Although it cannot be claimed that the air-lift pump, when used for raising water from deep wells and similar places, is able to compete in point of efficiency with high-class barrel pumps, it is, however, for many purposes so convenient and useful that there are many cases in which its advantages outweigh those of mechanically-driven pumps. Unfortunately, in some instances where air-lift pumps have been tried, it has been found that their efficiency has been rather low; and there has, no doubt, on this score, been somewhat of a prejudice against them; which, though not unnatural, has probably frequently prevented their use in places and under conditions for which they were well adapted. Although their efficiency has been lower than that of the deep-well barrel-pump, it has been improved of late years, and particularly so by the adoption of the tapered delivery-pipe, which now bids fair to bring the air-lift pump into greater favor.

The principle of the pump is, of course, understood by engineers, although, perhaps, the latest improvements that have been made in it are not so well known. In its simplest form it consists of a pipe, which is placed in the water to be pumped, a part of the pipe being in the water and a part out. Inside or outside this pipe is another tube, down which compressed air is forced, the bottom of the air-tube being so arranged as to deliver the air inside the water-tube, which is open to the well at the bottom. Before the air is admitted the level of the water is the same in both tubes, but when the air pressure is applied the water in the air-tube is forced down and mixes with the water in the water-tube. When the air has forced all the water out of the air-pipe, it flows out itself, mixes with the water in the water-pipe, making the column lighter, and causing the water to rise to a height which bears a relation to the immersion, and consequently to the pressure of the air supplied.

A Mr. Crockford appears to have applied the principle in America, in 1846, for the purpose of pumping petroleum from several Pennsylvania wells. After that time the invention lay dormant for some considerable time—indeed, until revived by Dr. Pohle about 1898. It was then applied by him for raising water on a large scale in America.

The rising main of the ordinary air-lift pump is of equal diameter throughout, and experiments have shown that layers of air rise in the main alternately with water; and as the layer of air rises in the main, the pressure above it, of course, grows less, at the top the pressure being only that of the atmosphere. If it can do so, the air will expand gradually on its way up, until at the top the length of tube that it occupies will be several times greater than that which it occupied at the bottom; or, in other words, much of the energy of the air is absorbed by giving the water a rapid motion, which is not required. This point has been very carefully studied by Mr. Joseph Price, of Messrs. Le Grand & Sutcliff, Bunhill-row, London, who has for a long time been investigating the matter, with the result that the firm mentioned have introduced a form of air-lift pump in which the rising main is gradually widened from the bottom towards the top. By this arrangement it will be seen that the air can expand laterally, and the layers of water will have only a slightly higher velocity at the top of the pipe than at the bottom. The energy expended in giving a higher momentum to the water as it rises is thus saved.

Very striking results have been obtained with this form of pump, much higher efficiencies being obtained by it than with the original apparatus, and several extensive experiments have been made in order to test the new arrangement. One of these, which we recently saw carried out at the Wandsworth and Putney Gas Works, is of so much interest that we place the results before our readers.

The air-lift pump on which the tests were made was placed in an artesian-well boring 7¼ in. in diameter, which extends to a depth of 630 ft. below the surface, and terminates in hard chalk. The well is lined continuously with steel tubes to a depth of 284 ft. below the surface, the upper part being surrounded by another steel tube 11½ in. in diameter, which reaches to 54 ft. below the surface, the space between the inner and the outer tubes being filled with cement-concrete, so as to protect the tube proper from any corrosive action of the waters of the surface beds. The "rest" water-level, before pumping, stood at about 154 ft. below the surface; and, during a preliminary test, indications of a probable supply of 5,000 gallons per hour being obtained, arrangements were made for raising that quantity.

The pump employed was one of the "Multex" air-lift pumps on Price's patent taper-tube system, and the compression of the air was effected by a horizontal tandem steam-driven compressor of 12-in. stroke, with two-stage compression. All the cylinders were double-acting, the steam cylinder being fitted with a piston slide-valve, and the air-cylinders with Matthewson's inlet and delivery valves. The air, partly compressed in the first cylinder, was passed through an inter-cooler fitted with copper tubes; the cooled air then entering the high-pressure cylinder was further compressed to the working pressure, and delivered to a steel receiver, where any oil carried from the cylinders was deposited. From the receiver the air was conveyed a distance of 120 ft. to the air-lift pump, where it was connected by a length of metallic hose to the air-pipe passing down the well (in this case outside the rising main) to an annular ejector at the bottom. By a special arrangement the whole could be raised or lowered, and the annular passage through the delivery valve of the ejector increased or decreased, as desired, to ensure the most effective action.

The proper size of the annular opening once having been found, no further adjustment is required. The effective length of the rising main from the ejector to the delivery was 580 ft., and a pressure gage on the air-receiver gave the pressure of the air and its equivalent head in feet. The immersion could thus be measured by simple inspection. The head due to the working pressure on the gage was 330 ft., 6 ft. of which was found to be due to friction in the pipes, leaving 324 ft. as head; and this, subtracted from 580 ft., the total length of the rising main, gives the effective lift as 256 ft. The delivery was some 33 ft. above the surface; so that the water level in the well, while pumping, stands at 223 ft. below the surface, or 69 ft. below its normal level.

The water, after being delivered to an open cistern, to allow the air to separate from it before delivery into the dis-

tributing system of the gas works, was, for test purposes, passed through a valve into a tank provided with steadying screens, and a weir 1 ft. wide; the height of the still water was recorded on a strip of paper on a drum rotated by clockwork, thus furnishing a timed record of the actual flow over the weir.

During the test the air-compressor was run at 150 revolutions and at 160 revolutions per minute; the recorder showed an average flow of about 2 in. over the weir, or about 15 cubic feet per minute, and the efficiency of the compressor was then taken on the method usually adopted, of counting the number of strokes required to fill a measured receiver from atmospheric pressure to the working pressure, and correcting for differences of temperature, to ascertain the volume of free air actually compressed for this purpose. The measurement of the receiver was 9.6 cu. ft., or, with the pipes and valve chambers, exactly 10 cu. ft.; which space was filled to 135 lbs., the working pressure, by 164 strokes (the average of three observations), which, with corrections for temperature, means a compression of 0.51 cu. ft. of free air per revolution of the engine. Thus, at 150 revolutions, and 0.51 cu. ft. per revolution, 76.5 cu. ft. of air were compressed to raise 13¼ cu. ft. of water, or a ratio of air to water of 5.8 to 1, and this while raising the water 256 ft., with an immersion of 324 ft., or a ratio of 56 per cent of the total length of the rising main. Further particulars of the tests are given below:

Revolutions of compressor per minute	150	160
Free air compressed, in cu. ft.	76.5	81.6
Height of flow over 12 in. weir	1⅞ in.	2 in. full
Equivalent delivery in cu. ft.	13.2	14.54
Volume of air per volume of water	5.8	5.61
Horsepower equivalent of water lifted	6.4	7.04
Horsepower as per indicator diagrams from steam cylinder	17.8	19.6
Efficiency of plant	36 p. c.	36 p. c.
Ratio of immersion to height of rising main	56 "	56 "

As the quantity of air required increases materially as the proportion of immersion to lift decreases, to enable comparisons to be made it is essential to reduce records to a common standard, preferably 60 per cent of immersion to 40 per cent of lift, which has been found to give the best results. The correction of the above figures to this standard gives the volumes of free air required per cubic foot of water raised as 5.05 and 4.87 cu. ft. respectively; and as under similar conditions the best records of other air-lift pumps indicate a probable requirement of about 8 cubic feet of free air to be compressed, the claim that the tapering tube-pump will raise half as much more water as can be done with parallel tubes, with the same power, seems to be supported; the exact ratio in this case is 160 to 100.

Although the air-lift pump is not so efficient as a first-rate barrel pump, it is obvious that it has advantages under certain conditions, one of the greatest of these being that the working parts and machinery may be at a great distance from the well.

Another advantage is that it is quickly and easily installed. Now that the efficiency of this system has, by the use of the tapered pipe, been so much increased, there does not seem any reason why the air-lift pump should not be more used than it has hitherto been.

TURBINE STEAMERS OF THE YEAR.

The tonnage of the turbine steamers launched during 1906 was very high, owing to the floating of the Lusitania at Clydebank and the Mauretania at Wallsend; but the number of vessels was not so large as to be worthy of special note. The following is a list of the vessels as they appear in our returns, with the tonnage and builders of each:

Vessel.	Tons.	Builders.
Lusitania	33,000	John Brown & Co.
Mauretania	33,000	Swan, Hunter & Wigham Richardson.
Immingham	2,009	Swan, Hunter & Wigham Richardson.
H. M. S. Dreadnaught	17,900	Portsmouth Dockyard.
Rewa	7,003	Wm. Denny & Brothers.
Creole	6,000	Fore River Ship Building Co., Quincy, Mass.
Yale	4,500	Roach's Ship Yard, Chester, Pa.
Governor Cobb	2,525	Roach's Ship Yard, Chester, Pa.
St. George	2,456	Cammell, Laird & Co.
St. Patrick	2,387	John Brown & Co.
St. David	2,387	John Brown & Co.
Marylebone	1,972	Cammell, Laird & Co.
Viper	1,713	The Fairfield Co.
Kingfisher	871	Wm. Denny & Brothers.
Duchess of Argyll	583	Wm. Denny & Brothers.
Atlanta	486	John Brown & Co.
Five T. B. D.'s	1,500	J. S. White & Co.
Three T. B. D.'s	681	J. I. Thornycroft & Co.
Total	120,973	

ADRIATIC'S MAIDEN VOYAGE.

It is announced that the White Star line's new palatial steamer, Adriatic, 25,000 tons, will make her maiden voyage to New York from Liverpool, and not from Southampton. As already stated, she will leave Belfast at the end of April, and proceed to Liverpool. After having been open for public inspection for some days, the Adriatic will sail direct from Liverpool to New York. For this voyage the bookings are proceeding with considerable rapidity. The Adriatic will sail from New York on May 22 for Southampton, and she will inaugurate the new mid-weekly service from that port on Wednesday, June 5.

The White Star line, in conjunction with the London and South Western Railway Co., have completed special arrangements for conveying passengers to and from Southampton. On the morning of each sailing day a special express train will leave Waterloo station, London, at 7:30 with second and third-class passengers, and another special boat train will leave Waterloo at 8:55 with first-class passengers, and the steamer will sail at 11 a. m. In like manner special train services will be run from Paris to Cherbourg. They will leave the former city at 8:45 a. m., and will arrive at Cherbourg in time for the passengers to join the steamers leaving at 4:30 p. m., and which are to sail direct to Queenstown to embark the mails for America.

The inward steamers will proceed direct to Plymouth to land mails; thence to Cherbourg, and from there to Southampton. At Cherbourg the passengers will be disembarked and embarked by the Birkenhead ferry steamer Birkenhead, which has just been purchased, and which will be converted into a tender with a new name.

Harland & Wolff are about to establish a branch of their engineering plant at Southampton.

SUBMARINE RAISED.

The raising of the ill-fated French submarine, Lutin, which sank in 150 ft. of water has been accomplished. This is a remarkable operation owing to the depth of water, but it was safely brought about by means of a floating dry dock which was lowered below the water line and the submarine attached by heavy chains. The dock was then raised by emptying her water tanks and the dock and submarine towed into port.

An English invention recently put forth offers a detachable compartment, in which several persons might escape provided the submarine strikes the bottom in a position to allow of releasing the compartment.

NEW STEAMER FOR FARRAR TRANSPORTATION CO.

This vessel, now building by the Collingwood Ship Building Co. for the Farrar Transportation Co., will be second to none on the great lakes in construction, equipment and outfit, and the owners have spared no pains in going thoroughly into all new ideas, regarding construction and ease of operation, so that the vessel as specified will be thoroughly up-to-date in all particulars. She will be christened Collingwood.

She is of the single deck bulk freight type, built on the arch and web frame system, without hold beams or stanchions. The spar deck is continuous all fore and aft, with raised top gallant forecastle with pilot house and texas on same, and deck house aft, containing coal bunkers, boiler house, galley, two dining rooms and crew's quarters. Accommodation for such part of the crew as is not housed in the after deck house to be in the forecastle and in the upper boiler house and on the fantail aft.

Between the forward and after house will be eleven cargo hatches 10 ft. long, fore and aft, spaced 24 ft. centers. The hatch covers will be of 3½-in. white pine.

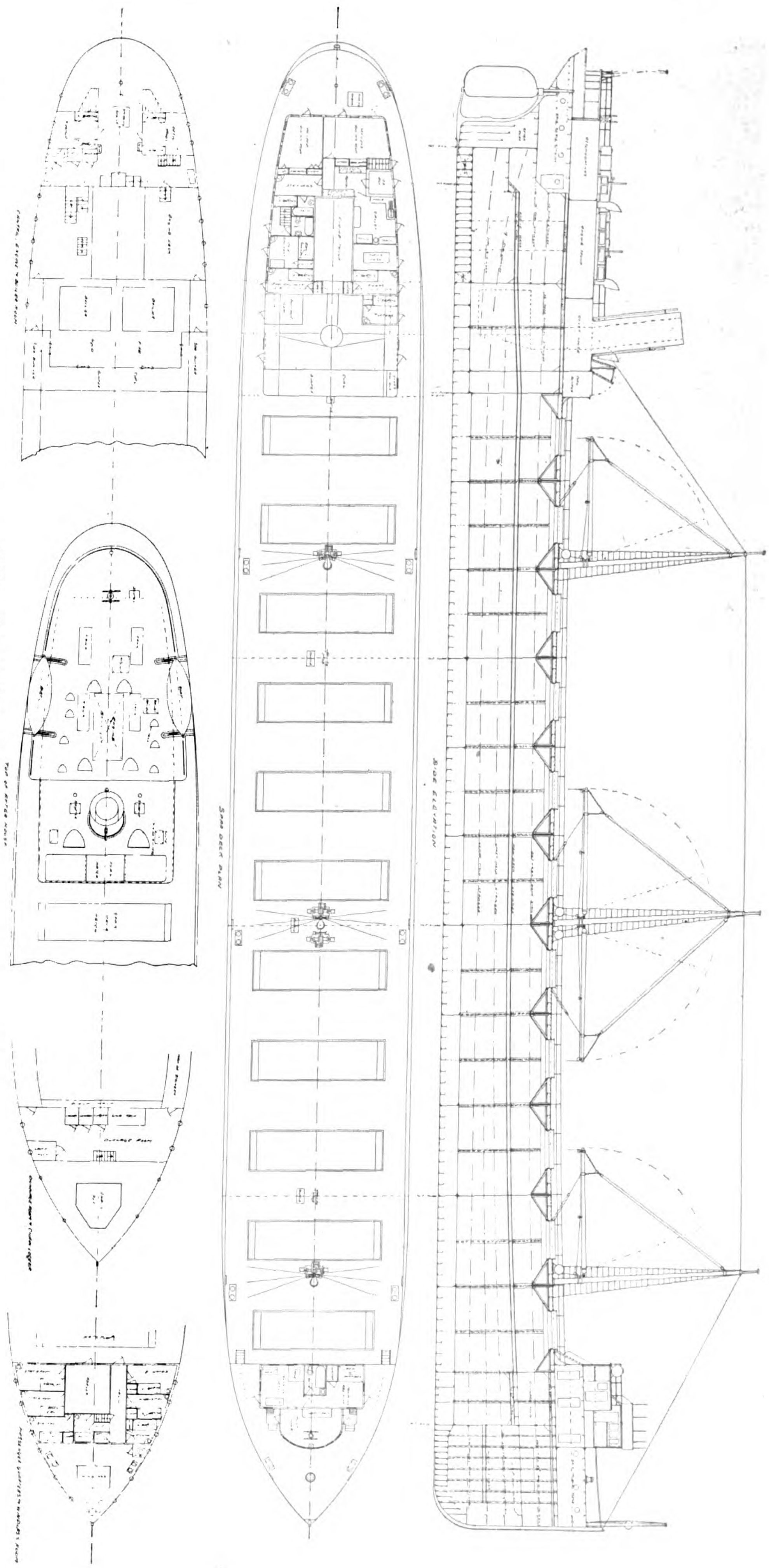
She is to be fitted with a double bottom for water ballast, five feet deep, extending from collision bulkhead to after peak bulkhead, divided into nine watertight compartments, with manifold and pumping system located in engine room.

She will have three steel masts fitted with booms and rigging for handling cargo.

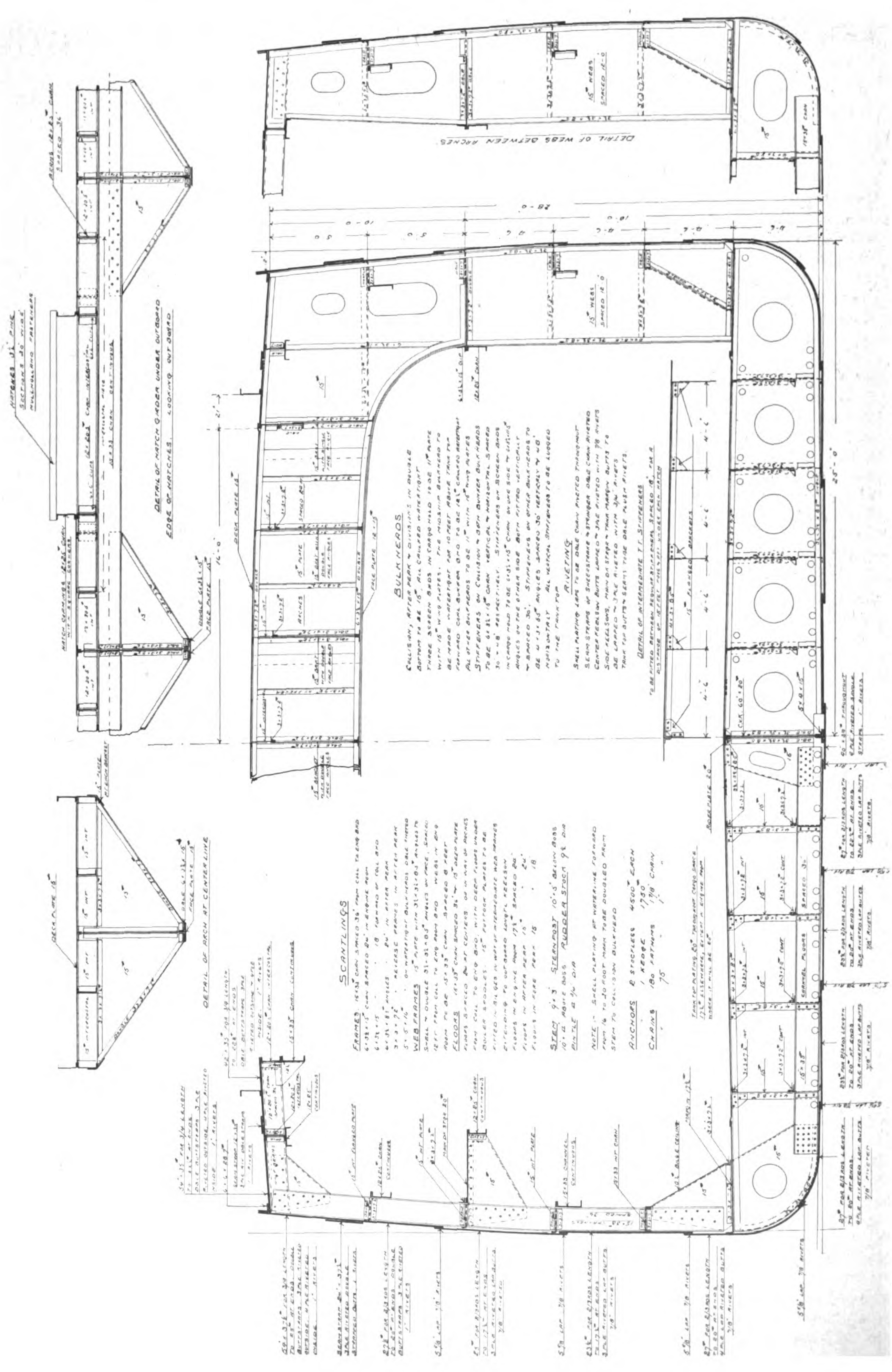
The propelling power will consist of triple-expansion engine with cylinders 21 in., 33½ in. and 57 in. diameter by 42-in. stroke, supplied with steam from two Scotch boilers, 14 ft. diameter by 12 ft. long over heads, working pressure 180 lbs., each boiler containing three furnaces. The boilers will be fitted with patent bridge walls and flue blowers.

Under the forecastle, passenger quarters will be provided, consisting of a parlor and three staterooms, all finished in quarter-sawed oak, fully paneled. The dining rooms aft will be finished in a similar manner. The cabins and quarters throughout will be furnished in the most approved style.

The design, drawings and specifications of this vessel were drawn up by H. N. Herriman, of the Great Lakes Register, Cleveland, O., and the vessel is being built under the supervision of the Register to obtain the highest rating.



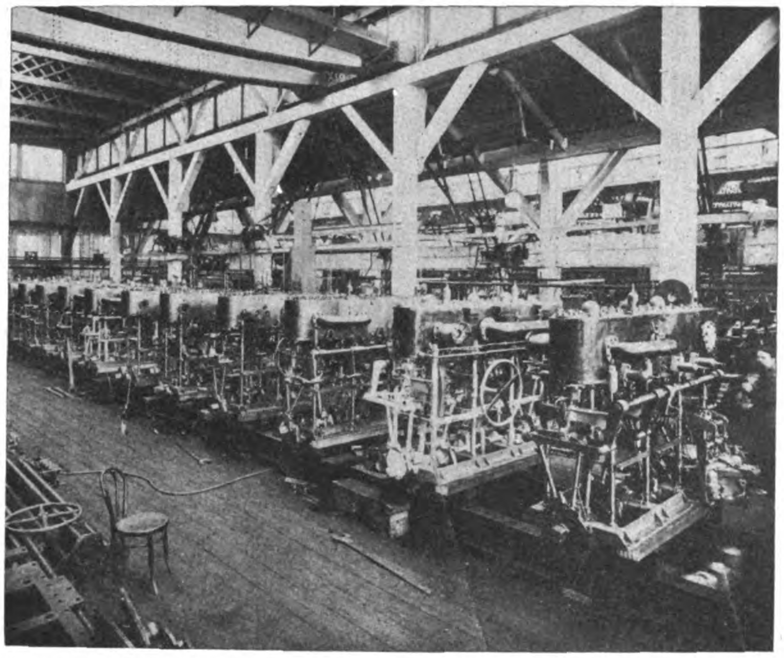
PROFILE AND DECK VIEWS OF THE BULK FREIGHTER COLLINGWOOD.



MIDSHIP SECTION OF THE STEAMER COLLINGWOOD.

FERRY STEAMERS FOR THE HOOGHLY

Messrs. John I. Thornycroft & Co., Ltd., Woolston Works, Southampton, have recently completed for the Commissioners of the port of Calcutta seven twin screw ferry steamers for service on the Hooghly. These vessels were ordered in May, 1906, and the whole of the work has been carried out under the superintendence of Mr. J. H. Apjohn. Shipment was specified to commence six months after the order and to be completed in nine months, i. e., by February, 1907. Messrs. Thornycroft have, however, anticipated this, as shipment of all the boats and machinery will have been completed in November, so that the work will have been completely carried out in *six* months, a smart piece of work. These vessels are 100 ft. long between perpendiculars, 20 ft. in beam, and 10 ft. moulded depth, and have a maximum draught of 5 ft. fully loaded, the guaranteed speed being 12 knots.

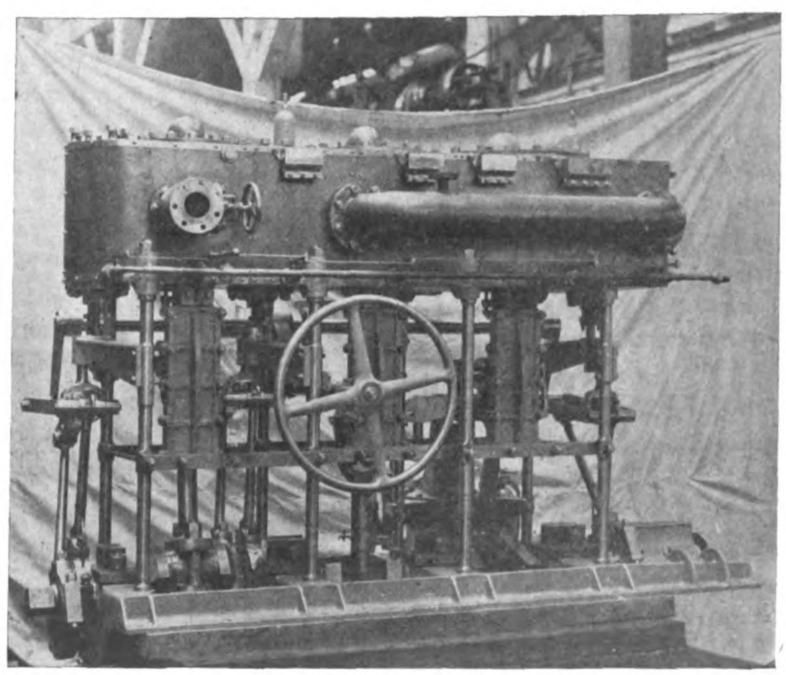


ENGINES FOR HOOGHLY RIVER FERRY STEAMERS IN THORNYCROFT'S ERECTING SHOP AT CHISWICK.

They are arranged to carry in all about 200 passengers; seating accommodation has been arranged for 100 of these. The passenger space is divided into two classes, the first class being situated forward on the upper deck in front of the boiler casing, and separated by portable barriers from the remainder of the space which is set apart for second class passengers.

On the upper deck there are three wide gangways on either side, giving ample room for embarking large numbers of passengers quickly. One of these gangways is arranged for first class passengers and the other two for the second class. The upper deck has a fine area and will be capable of accommodating a large number of passengers with comfort. A light wood awning covers this deck.

Access to cabins is gained by three open companions. Two are situated forward, one being for access to first class lavatory and the other for access to second class cabins. Seats are arranged all round the forward and after cabins, thus affording ample seating accommodation. Ample ventilation has been provided for by means of cowl vents through deck to cabins' and louvre vents have been fitted around ships' sides.



ENGINES OF FERRY STEAMERS FOR THE HOOGHLY.

The vessels are fitted with twin screw triple-expansion engines developing 500 I. H. P. at about 275 revolutions per minute. As will be seen from the illustration, although the design is light, it is very substantial and has very ample bearing surfaces, making the engines very reliable for continuous service.

The cylinders are separate castings, with receiver pipes in accordance with admiralty practice, the diameters being 9 in., 13 in. and 20½ in. by 11 in. stroke. The high pressure and intermediate pressure slide valves are of the piston type, but that for the low pressure is flat. The framing is of turned steel columns and forged bars, with cast iron bed-plate. The link motion is of the solid link Stephenson type, with eccentrics solid on the crank shaft, which is all in one forging to give a compact engine. The air pumps, and two main feed pumps, are driven by levers off the low pressure crosshead. Separate condensers (steel, with cross tubes) are provided and fitted with independent circulating engines.

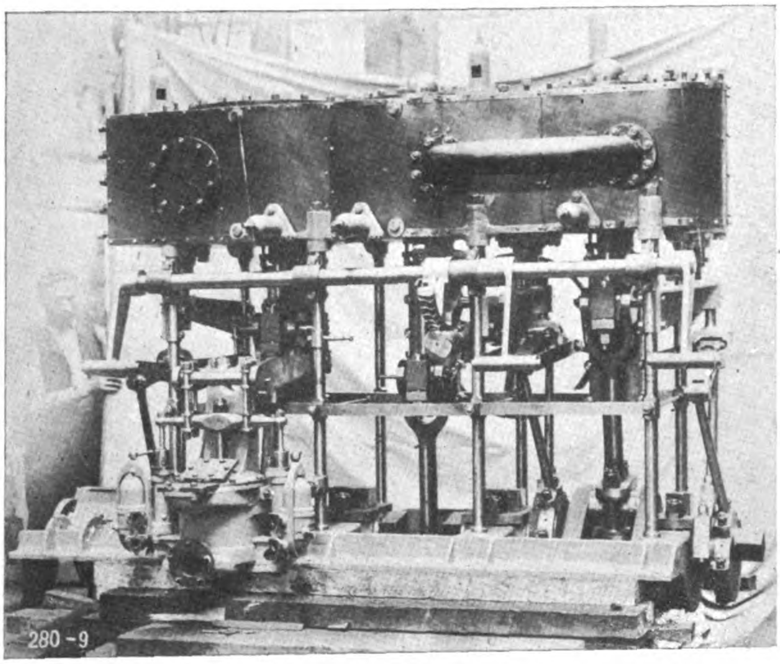
The shafting is of steel, without liners, as the stern tubes are of steel with white metal bushes. The propellers are of gunmetal cast solid.

Steam is supplied from a boiler of the cylindrical return tube type, working under a pressure of 180 lbs. per square inch,

and fitted with two Morrison renewable suspension furnaces, with large grate surface arranged for burning Indian coal under forced draft supplied by a 48 in. fan on the closed stokehold system.

The machinery includes auxiliary feed pumps, large auxiliary bilge pumps and bilge ejectors. The vessels are lighted throughout by electricity furnished by a 3.3 K. W. engine and dynamo set generating current at 100 volts.

The boats, engines and boilers have been entirely constructed by Messrs. Thornycroft, and the accompanying photos of the machinery well illustrate the design and construction of the engines.



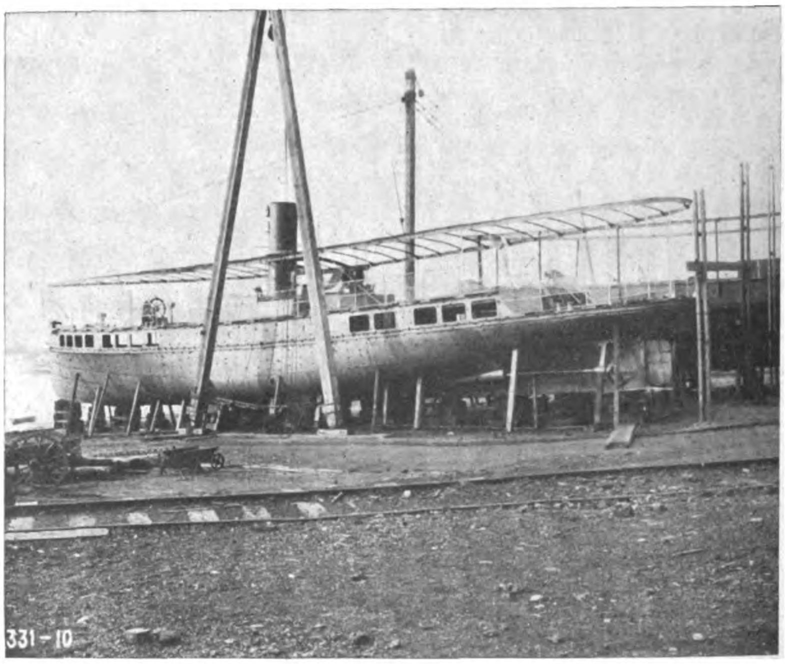
ENGINES OF FERRY STEAMERS FOR THE HOOGHLY.

INTERNAL COMBUSTION OF MARINE ENGINES.

Mr. J. T. Milton, of Lloyds Register, read a paper on "Internal Combustion Engines for Marine Engineers," at a meeting of the Institution of Civil Engineers, on Jan. 22. The economy and the increasing use of internal-combustion engines on land had led, Mr. Milton said, to considerable interest being taken in their application to marine purposes, and already a large number of such engines had been fitted in small craft on the continent, in most of which heavy mineral oil was the fuel used. On land various fuels were used for these engines, such as petrol, refined oil, heavy oil, coal-gas, producer-gas, coke-oven gas, and blast-furnace gas, but for marine purposes generally producer-gas and heavy oil were at present the only available fuels. Only the mechanism and arrangement of the engine were discussed, however, in the paper. Very large engines were in use on land, and the experience of details necessary to make the large cylinders capable of withstanding the shocks of explosion and the high temperatures of the burning fuel would be available for marine engines if the other necessary mechanical requirements were complied with. The special conditions required for a successful marine engine are: (*a*) The engine must be reversible; (*b*) it must be capable of being quickly stopped and of being quickly started, either ahead or astern; (*c*) it must be capable of being promptly speeded to any desired point between full speed and dead slow, which latter speed ought not to be greater than one-quarter of the full speed; (*d*) it must be capable of working well, not only in smooth water, but in heavy weather in a seaway in which the varying immersion of the propeller causes rapidly changing conditions of resistance.

In large engines these conditions prohibited the use of movable-bladed propellers, clutches, and toothed gearing, and also of a fly-wheel, and necessitated the use of a reversing engine with a direct drive on to a fixed propeller. They required also a fairly equable turning moment at all working speeds. In marine engines the revolutions were practically proportional to the speed of the ship, and as the vessel's resistance increased much more rapidly than the speed, it followed that for a reduction of speed of revolution the mean effective pressure must be reduced much more than in proportion to the revolutions. This was a much more difficult problem in marine engines where no fly-wheel was practicable, than on land, where the use of a heavy fly-wheel permitted the suppression of alternate fuel charges. With the four-stroke cycle, where one single-acting cylinder only was employed, the fluctuation of moment varied from 7.7 times the mean moment in a forward direction to 1.5 times the mean moment in the reverse way. With two such cylinders, or with one double-acting cylinder, the motion was better, but was still unsuitable, and the minimum number of cylinders which would always give a positive turning-moment was four single-acting or two double-acting.

Diagrams were shown of the turning-moments resulting from a vertical two-cylinder tandem engine with one crank;



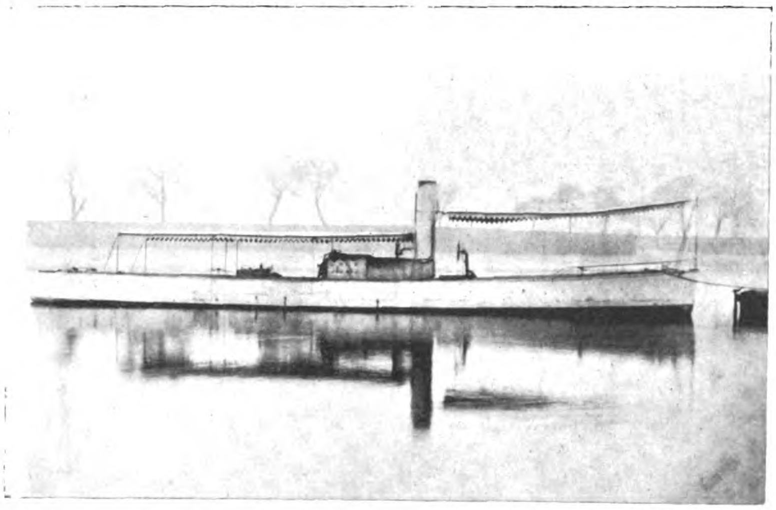
FERRY STEAMERS FOR THE HOOGHLY.

also of three such engines working on one crank-shaft with the cranks at equal angles, and of four such engines with cranks at equal angles, and at intermediate positions, and the inference was drawn that the arrangement with the three cranks was, on the whole, preferable for marine work. Such an engine, however, working on the four-stroke cycle would not give the range of low speed necessary for marine work. If the compression and expansion was done in separate cylinders the compression-cylinders were not subjected to the very high pressures and high temperatures produced by ignition, but, on the other hand, there was considerably more work performed in the compression-cylinders, as the gas had not only to be compressed, but also to be forced out of the cylinders. The extra work necessary for this might, however, for the most part be returned by making the expansion-cylinder with a minimum of clearance, and arranging for the admitted charge by its pressure to force the piston some part of the stroke before ignition. By that arrangement separate compression and expansion could be arranged for without much loss of economy. The arrangement permitted of other advantages. As the clearance was minimized, there was practically no burnt gas left in the cylinder unduly to dilute the charge. The mean pressure could therefore be reduced in two ways—(1) by diluting the charge with excess of air down to the lowest firing proportion; and (2) by throttling the supply. It might also be possible to arrange for an earlier cut-off.

Altogether the arrangement would permit a much lower mean pressure to be obtained than was possible with the four-stroke cycle. Further, by admitting only compressed air suitably throttled, the engine would work at very low speeds, in the same way that a steam-engine would work when throttled. An incidental advantage was the complete suppression of the two-to-one gear. An installation which, Mr. Milton thought, would be suitable for marine purposes consisted of an independent main engine driving the screw, having three double-acting expansion cylinders with three cranks set at equal angles. The compression was proposed to be effected by a separate engine without reversing gear, having two sets of tandem engines, four cylinders in all, working on the four-stroke cycle driving two-stage air and gas compressors. The compressors would deliver into storage-receivers, from which the main engine would receive its charge.

TUNNEL SCREW LAUNCH FOR INDIA.

Messrs. John I. Thornycroft & Co. have recently completed at their Chiswick works a tunnel screw steam launch for the Madras forest department. This vessel has been built to the designs and specification of Sir Alexander Rendel, and has been constructed under the special supervision of Seymour B. Tritton. The leading dimensions are, length 67 ft, beam 9 ft. 8 in., draught 1 ft. 6 in., in working order. The light draught will enable the vessel to be navigated in shallow water and the placing of the two screws (which are on the same shaft) in a tunnel obviates the liability of damage to them in service. The contract speed was 13 statute miles per hour when burning wood as fuel and this was easily maintained on the official trial on the Thames.

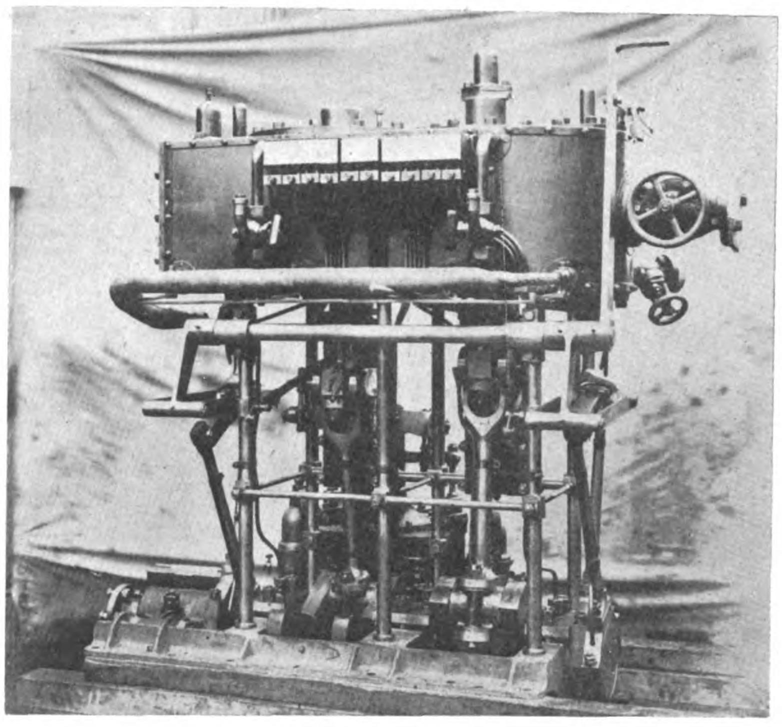


TUNNEL LAUNCH FOR FOREST DEPARTMENT, INDIA.

The engine is of the inverted direct double acting compound type and was built by Messrs. Thornycroft at their Southampton works. The working pressure is 130 lbs. and the indicated horsepower at 400 revolutions per minute is about 100.

The cylinders are respectively 6¾ in. and 13½ in. diameter by 8½ in. stroke. The boiler is of the marine loco type, specially designed to burn wood as fuel. It has a heating surface of 130 sq. ft. and a grate area of 15 sq. ft.

The trials were very satisfactorily completed and the vessel was then dismantled and packed for export. The boat was built in three sections to facilitate transport in India. The sections will be re-erected by native labor in India, the various parts being numbered to facilitate this work. The Thornycroft launches have achieved a world-wide reputation and are, in fact, of world-wide distribution.



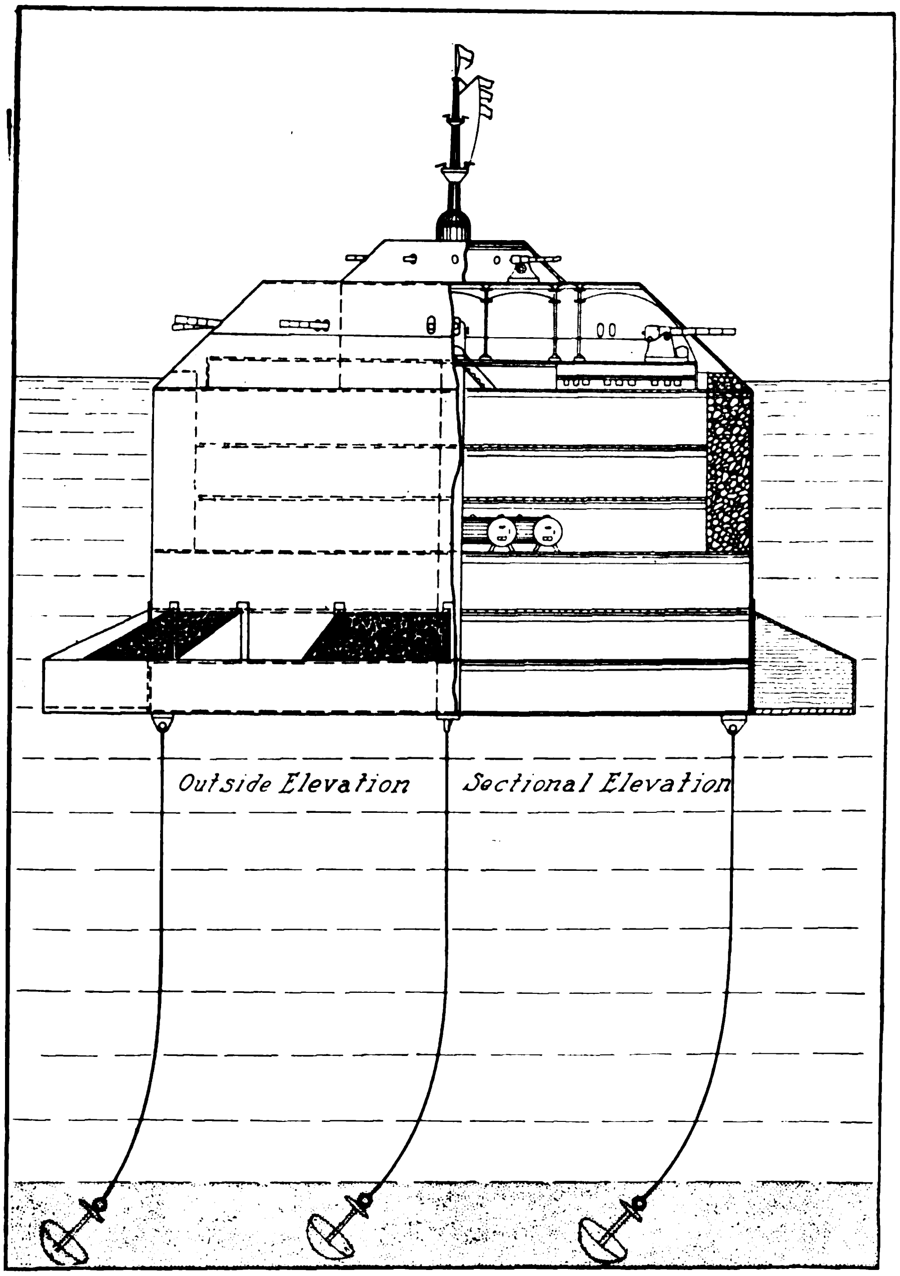
ENGINE OF TUNNEL LAUNCH FOR FOREST DEPARTMENT.

THE MURRAY MARINE STEADY-FLOATING STEEL STRUCTURES.

The accompanying illustrations show a sectional end view of a proposed floating breakwater, the invention of William Edward Murray, of Los Angeles, Cal., which, it is claimed is going to revolutionize the methods of breakwater construction.

In principle, this breakwater consists of a steel structure, shaped like an inverted boat, floating sufficiently submerged in water as to prevent the impact of the waves on the upper part, within the wave disturbed area, from moving it to such an extent as to render it unstable. The addition of a flange at the base of the structure increases the resistance and amount of surface acting against the dense immovable body of water surrounding the base, and makes the invention practicable where there is not a sufficient depth of water to secure the necessary amount of resistance by submerging a structure in the form of a tube or tower.

In building each section of the breakwater, the flange will be constructed and launched, the upper part of the caisson being added after it is afloat. The flange may now be packed with some suitable ballast, such as gravel or rock. The base of the caisson will be divided longitudinally into water-tight compartments, which can be filled when the structure has been towed to its position, thus sinking it to the necessary steady-floating point. To keep the breakwater in position, any number of anchors, of massive concrete blocks or other suitable material, may be employed. The danger of ramming is provided against by the provision of water-tight bulk heads placed at intervals of about 20 ft.



INTERIOR AND EXTERIOR ELEVATION OF MURRAY FLOATING BREAKWATER.

On the upper floor or deck will be installed the necessary pumping machinery, and from this deck, also, the anchor chains will pass down, through a tube or sleeve in the center of the structure, to the ocean bed.

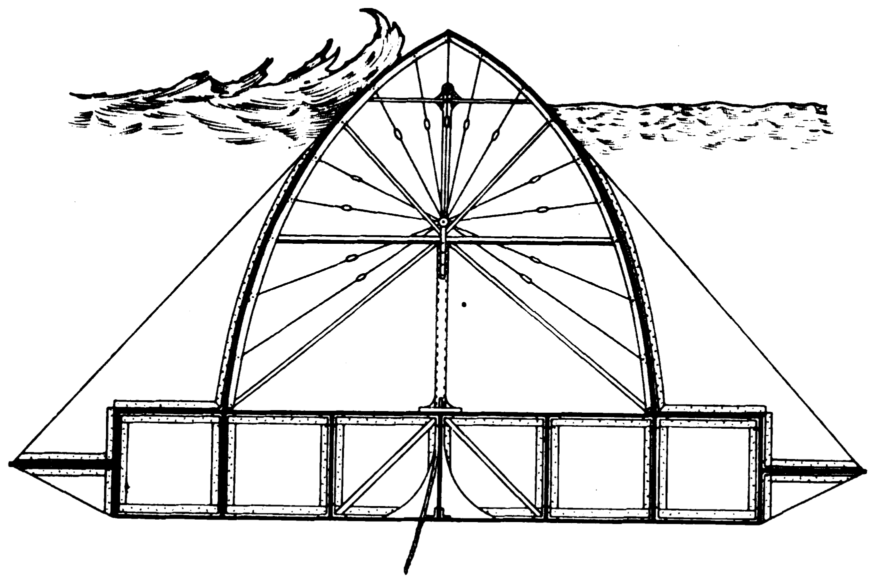
Any number of these structures may be employed in the construction of a breakwater, and can be moved at any time to a more desirable location. The total weight of steel in one of these structures will be about 168 tons per section of 20 ft., or 8.4 tons per lineal foot of breakwater. This makes a total weight per mile of breakwater of 44,352 tons. At $50 per ton, the estimated cost of construction, one mile of breakwater would cost $2,217,600. With the cost of painting, anchorage and accessories, an aggregate sum of $2,500,000 per mile would be reached comparing favorably with the cost of many notable breakwaters of the world.

The advantages of such a breakwater at places where the extreme depth of the water has hitherto been a barrier, can be readily appreciated, as can also the ability to add or remove sections at will. Once the principle of the steady-floating foundation is granted, it is obvious that there would be no end to the uses to which such a structure could be applied. Floating fortresses, to be anchored at any desirable location, lightships and lighthouses, coaling stations, marine hospitals, etc.

As steel is to be exclusively used in the building of these structures, it follows that a demand for them will mean a corresponding demand for steel and steel workers, opening up a new field in the steel industry.

The steamship La Plata of the Royal Mail Steam Packet Co., left New York recently for Southampton, England via the West Indies, equipped with the De Forrest system of wireless telegraphy. The La Plata is the first passenger ship to cross the Atlantic with the American installation of this system. All the steamers of the Royal Mail Steam Packet Co. sailing between Southampton and New York are to operate this system. Four steamers of the Scandanavian Line operate the De Forrest system, but these were equipped by the English De Forrest Co., which is quite distinct, except in a corporate way, from the American.

The Armstrong Cork Co. has moved from the Farmers' Bank building to 1010 Union Bank building, Pittsburg.



SECTIONAL END VIEW OF MURRAY FLOATING BREAKWATER.

TRIMMING WEIGHT FOR STEAMBOATS.

This trimming-weight, the invention of Charles Calixte Rouillard, of Montreal, Canada, consists essentially of a balancing weight traveling in a guideway suitably supported from side to side of the vessel, and means for controlling the movements and position of the said weight, and has for its object the provision of a means of keeping the vessel constantly trimmed without the necessity of handling the baggage or cargo when the vessel is under way.

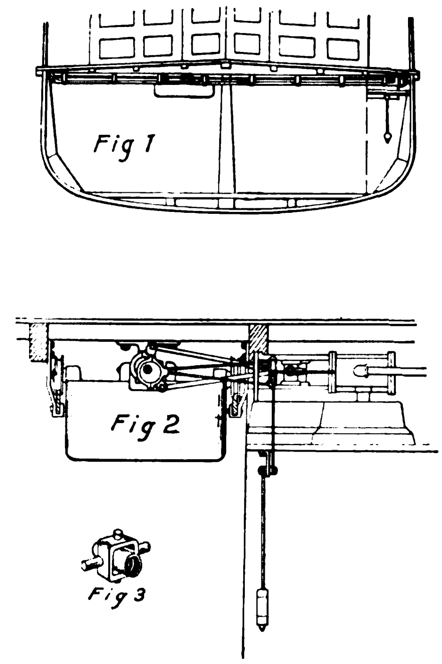
The accompanying illustrations are two views of the trimming weight in position, Fig. 1 showing a cross-sectional view of the vessel with the trimming device suspended under the main deck, Fig. 2 shows an enlarged end view of the parts in detail.

This traveling weight runs on hangers suspended preferably under the main deck, the pulleys on which the weight runs being attached to four lugs or projections on the side of the weight. Attached to two lugs at the center of the top of the weight is a flexible thimble, threaded internally. See Fig. 3. A threaded shaft, supported in suitable bearings, is arranged in proximity to each side of the vessel. On this shaft the thimble and consequently the weight, travels.

At the immediate side of the ship is placed the motor actuating the shaft. The motor herein shown is an ordinary reciprocating engine, though any suitable type of motor may be applied. The cranks of the engine are secured to the threaded shaft, so that any movement of rotation of the crankshaft will affect the position of the weight.

The reversal of direction in the rotation of the shaft is accomplished by the ordinary link-motion reversing gear, the link being connected to the valve spindle in the usual manner.

Beneath the motor or engine a plumb-rod, pivoted at its upper end, is attached to the reversing gear in such a manner as to control the admission



TRIMMING WEIGHT FOR STEAMBOATS.

of the steam to the cylinders and operate the shaft in either direction.

Among the advantages claimed for this system are: Listing of the ship, which is not only dangerous, but interferes with the progress of the vessel, is avoided; the usual practice of having movable weights or ballast, particularly on lake or river steamers, can be dispensed with; the automatic part of the invention obviates the difficulties now experienced; safety to passengers and deck cargo.

SHIPPING WORLD YEAR BOOK.

The Shipping World Year Book, edited by Major Jones, is at hand, a trifle delayed, owing to the time taken to make digests of the amendment to the merchant shipping act and the workmen's compensation act. This Year Book has grown to be a monumental affair and is constantly growing. The editions this year embrace the load line tables and the new tariffs of Canada, the South African Customs Union, Japan, Spain and Germany. The tariffs of all countries are revised up to date and the port directory of the world is the last word upon the subject. Major Jones is always interesting in his retrospective views and his retrospective for 1906 is no departure in this particular. He says:

The year 1906 came in with a rising tendency in the rates of freight, the cost of materials, and the price of new tonnage. Unfortunately, however, for the ship builder, the order book was still groaning under contracts made at "bottom prices," or thereabouts; while coal, ship plates, and all things which go to make a ship went climbing upwards from January to December. In addition to the displacement of tonnage through the operations of the war in the Far East, no less than 503,566 tons of second-hand British vessels were sold to foreign buyers during the year ended June 30, 1906; 63,197 tons transferred to Colonial registers; 158,087 stranded or lost at sea; and 46,111 tons broken up or dismantled during the same period, making an aggregate tonnage removed from the British register of 770,961 tons. That was a displacement well intended to inspire confidence to buy even in wise and cautious ship owners of hereditary advantages; and they did buy the famous Cunarders, the Adriatic, and other great ships, until the output of British yards and dock yards reached the unparalleled total of 1,921,897 (Board of Trade) tons, against 1,694,108 tons launched in 1905. Moreover, buyers were encouraged by the pledge of the Chancellor of the Exchequer to abolish the coal export duty, which disappeared on Oct. 31; and by the bounding prosperity of the over-sea trade, which for this country reached the unprecedented value of £1,069,000,000. These, with some loading provisions for foreign ships in British ports, are still potent influences making for better freights and prices for tonnage during the years 1907 and 1908. As a factor which had some influence in keeping freights low, the change in the load-line tables, which came into operation during the old year, and added about 1,000,000 tons to the car-

rying capacity of our merchant fleet, should be recorded.

STANDARDIZATION IN SHIPS, PARTS AND MACHINERY.

The work of standardization is advancing with great strides. The advantages derived from this, especially in economy of production, are great and obvious. The coming of the turbine has, to some extent, disturbed the scheme in respect of Admiralty ships. This, however, does not go beyond the main engines, for auxiliary machinery may be replaced in whole or in part with no greater relative difficulty than is involved in the replacement of the parts of a machine-made watch. Care must, however, be exercised lest standardization should go too far in stereotyping designs; and, it may be, in arresting invention and progress; our architects and builders are thinking of this. Speaking generally, developments in the construction of merchantmen have made for the elimination of obstructions in the holds, with a view to facilitating the handling and stowing of cargoes—towards providing the best ballast tank arrangements for vessels sailing light, and towards economizing labor by supplying means for the automatic trimming of cargo. The work of specializing or standardizing in ships, while it is not new, has further developed during 1906. Economy of construction by building many ships to the same model is an old idea; but year after year the needs and requirements of particular trades are further studied, considered and supplied. On the Clyde we have Mr. Burrell specializing with the "Straight-back" type of carrier; Messrs. Sir Raylton Dixon & Co., at Middlesbrough, are also large builders of the same type of ship with uniform transverse framing, the ballast tanks being arranged beneath the upper deck at the side, whereby the ship is made easier at sea. Messrs. Doxford & Sons, Ltd., on the Wear, are the originators of the "Turret" type, and may be said to have standardized with this class of ship; for during the last year they built ten ships of absolutely uniform dimensions and engine power, which affords immense advantage in the matter of cost; for it goes without saying that ten articles of a given pattern can be produced at a much cheaper rate than one. The Northumberland Ship Building Co., on the Tyne, also built a large number of vessels of identical tonnage; while the modern cargo boat is made to a common pattern and rounded off at bow and stern, whereby construction is simplified and cheapened. And in this way standardization is carried out, not only in parts of ships and machinery, but in vessels as a whole.

MEANS OF PROPULSION, OLD AND NEW.

The place of the turbine in marine propulsion is determined at the present moment; but not for long. The possibilities of saving steam wastage, and of improvements in maneuvering with oil fuel aids have been recognized by the Admiralty; and the necessary oil fittings and storage are now provided on our big fighting ships. Indeed, the decision of the board regarding turbines was made known last July. Certain disadvantages were recognized, but it was determined to adopt the turbine "because of saving in weight and reduction in number of working parts, and reduced liability to breakdown; its smooth working, ease of manipulation, saving in coal consumption at high powers, and hence boiler room space, and saving of engine room complement; and also because of the increased protection which is provided for with this system, due to the engines being lower in the ship—advantages which more than counterbalance the disadvantages." The obvious advantages on the score of space and speed have impressed all the great maritime powers, who are following the lead of the British Admiralty. Our principal engineering firms have now taken out the necessary license for making turbines, a fact significant of the value of the turbine and its further improvement. The Lusitania and Mauretania are auxiliary warships as well as great merchantmen, and the Admiralty argument in favor of turbines holds good concerning them. Each carries twelve 6-in. guns. They would be valuable in time of war as scouts and carriers of high speed and great power for carrying food and fighting supplies. As a business proposition, for long voyages, and at moderate speed, the reciprocating engine continues to be the most suitable and economical propelling machinery. How long this may continue to be so is among the unsolved problems of engineering. The Adriatic, built for the White Star line, was the great British ship of 1906 fitted with reciprocating engines. The Dreadnought turbines did not work evenly on her trials; but she is now in a satisfactory way, a fact borne out by the decision of the government to build three more of these ships during the current financial year. The engineer and chemist are still at work endeavoring to find the gas that is wanted, reduced from bituminous coal for the gas engine; and progress is made. Here, again, as with the turbine, space saving is a great consideration in favor of the new machinery. Gas turbines are also in men's minds. And the petrol motor is driving old-time small craft from their sphere. These motors have already been utilized for torpedo boats and other types of small vessels. A just survey of this field also must leave us satisfied with our inventors, engineers, naval architects and ship builders.

WHITE STAR PROMOTIONS.

Capt. John D. Cameron, of the White Star liner Oceanic, will probably not make more than one additional trip to this country. The International Mercantile Marine Co. have appointed him their general superintendent for the new mid-weekly Atlantic service from Southampton, and to act in the same capacity for the American line at that port. They have also appointed to the position of superintendent engineer of the same service at Southampton Mr. F. J. Blake, R. N. R.

Capt. Cameron is exceedingly well known in the Atlantic passenger trade. He is a Liverpool man, and was born in that city in 1851. He was educated at the Liverpool Institute, and served his apprenticeship with Messrs. H. Fernie & Sons, of that port. Leaving that firm he spent some years as an officer on the sailing ships of Messrs. Ismay, Imrie & Co. He joined the White Star line as fourth officer in 1877, and in less than seven years he secured the position of commander. He has had charge of most of the principal ships in the White Star line, and was appointed to the command of the Oceanic when she was launched in 1899, and has held that position up to the present time. It was while commanding the Teutonic in 1895, that the gallant skipper brought his vessel through the terrific blizzard and saved the lives of eleven men on the sinking fishing schooner Josie Reeves. Arriving off Sandy Hook he found the blizzard raging and decided it was too hazardous to attempt port. Putting to sea he fell in with the fishing vessel, which was rapidly sinking. Capt. Cameron ordered boats lowered from the Teutonic to take off the imperiled crew, but so fearful was the storm that the rescuers could not reach the schooner. Capt. Cameron kept maneuvering his ship until it sheltered the boats long enough for them to make their way to the sinking fishing boats and take of the imperiled men. For this service the captain received an appropriately engraved watch from the Life Saving Service, and each of the rescuers received a medal.

Mr. Blake is assistant superintendent engineer for the company at Liverpool. He is comparatively a young man, being only in his forty-first year. He is a senior engineer of the Royal Naval Reserve.

LAUNCHNG THE SARATOGA.

The steamer Saratoga of the Ward Line, launched this month at the Wm. Cramp & Sons ship yard, is the sister ship of the Havana which has just completed her maiden voyage, making excellent time in spite of the heavy weather encountered.

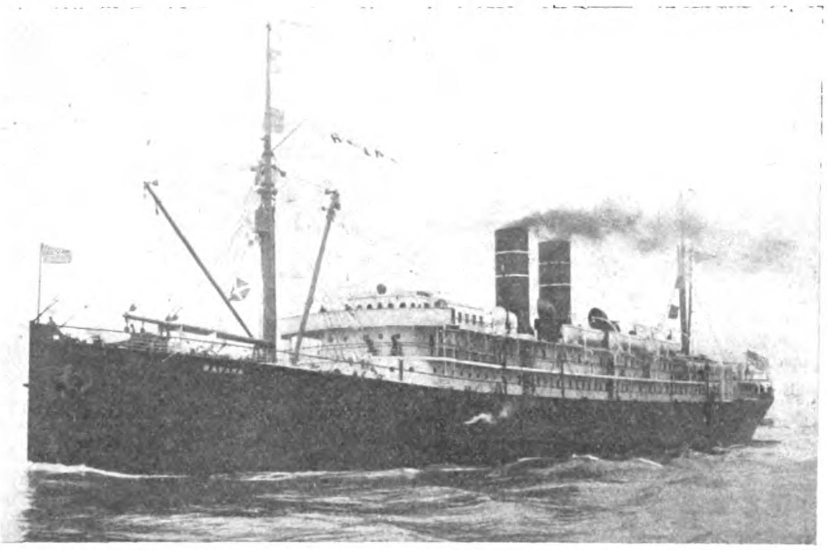
These steamers, built under the postal subsidy act provisions, are the embodiment of everything that is best in ocean going passenger steamers. Their dimensions are: Length over all, 429 ft.; beam 50 ft.; depth, 38 ft. They measure 6,391 gross tons, have a displacement of 10,110 tons, dead weight capacity 6,000 tons.

The propelling machinery consists of two sets of triple expansion engines of 11,026 H. P., with cylinders 32 in., 52 in., and 86 in. in diameter with a 48 in. stroke. Steam is supplied by 8 single ended Scotch boilers. The Saratoga and Havana are built for a speed of 18 knots per hour.

The passenger accommodations are luxuriously fitted up throughout the ships and no expense has been spared to make them the most perfectly appointed and handsomely furnished steamships in their trade. The first class state rooms, accommodating 210 passengers are situated on the saloon deck and promenade deck, and with the exception of a few rooms, are all outside rooms. Access may be had to each of these staterooms from the interior of the ship, thus avoiding the necessity of the passenger going on deck in heavy weather. The drawing room, situated on the promenade deck, is luxuriously equipped with lounges and divans for the comfort of the traveler. The smoking room, also on the promenade deck, is large and attractively furnished with a well appointed bar and other accessories.

The dining room, situated on the saloon deck forward, has a special arrangement of tables, and is exceptionally well ventilated. In the arrangement of the bathrooms, the most approved sanitary practice applies, being equipped with porcelain tubs and finished off in marble and porcelain tiling. Throughout the entire ship the passages, lobbies, smoking room, etc., are laid with interlocking rubber tiling.

There is accommodation, also, for forty-eight intermediate and twenty-four second class passengers, and a crew of 152.



STEAMSHIP HAVANA, SISTER OF THE SARATOGA.

WHAT, INDEED.

"No, ladies will never become great engineers," firmly remarked the engineer of a steamboat to one of the passengers of the male persuasion. "Once," he went on, "a lady engaged me in conversation, she asked me a marvelous lot of questions, and as she was nice-looking and very pleasant I answered as many as my poor weak brain could grasp. Then I opened up and told her just where the steam entered the engines through the stop-valve, went through the cylinders, how it escaped, and how it was that the pressure on the piston was conveyed to the crank-shaft which turned the wheels that propelled the ship through the water. She listened intently to it all, and when I had concluded she turned to me with a beaming face, and said, 'Now, what is the object of the boiler?'"

DISCOVERY OF SCREW EFFICIENCY ACCIDENTAL.

According to a noted ship builder, the small size of the screw of a ship is not due to the perception of any inventor of its greater effect as compared with a larger one, but purely to accident. Years ago, screws for steamers were made as large as possible, says a London weekly, it being the theory that the greater the diameter the higher the speed. A vessel was sent to sea with a screw so large that it was deemed best to cast each blade in two parts, afterwards welding them together. During a storm all three blades of the propeller snapped off at the welding, reducing the diameter by more than two-thirds. To the surprise of the captain, the vessel shot forward at a speed such as had never been attained before. Engineers then experimented with small propellers, and discovered that they were much more effective than large ones. Had it not been for that accident large bladed screws might still have been used to the present day.

FORE RIVER CO.'S WORK.

The Fore River Ship Building Co., Quincy, Mass., is making satisfactory progress upon the steel freighters that it is building for the Brunswick Steamship Co., which is the vessel end of the Atlanta, Birmingham & Atlantic Railway Co. The vessels are duplicates, 313 ft. over all, 40 ft. beam and 25 ft. 6 in. deep, and are of 5,000 tons displacement. There are three large cargo holds, having four hatchways, suitably arranged for the expeditious handling of freight. These cargo holds are isolated from each other by steel watertight bulkheads, which, with the collision, machinery space, and stern tube bulkheads, divide the vessel into seven separate water-tight compartments, insuring flotation with any two of the compartments flooded by the sea. The vessels are rigged with two steel pole masts, having four derricks fitted to each with a working capacity of 7½ tons per derrick. The propeling machinery consists of one set of triple-expansion, surface condensing engines, supplied with steam from two single-ended Scotch boilers.

The whaleback steamer City of Everett is at the Erie basin, New York city, receiving new furnaces and later on will have two large boilers installed in place of the four which she now has.

A new chart in colors of Les Cheneaux Islands has just been issued by the United States Lake Survey office and is for sale by the MARINE REVIEW.

THE MARINE REVIEW

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CHARLES WHITESIDE RAE.

Charles Whiteside Rae, who succeeded Rear Admiral George Wallace Melville as engineer-in-chief of the navy, was born June 30, 1847, in Hartford, Conn. He is a son of the late Rev. Luzern Rae. He was graduated from the Renssalaer Polytechnic Institute, Troy, N. Y., in the class of 1866 and from the United States naval academy, Annapolis, Md., in the class of 1868, the first class of engineers graduated from the naval academy. He served in various ships and all stations except the Asiatic during periods of sea service. Among other stations on shore he served two terms of four years each at the United States naval academy, the last one as head of the department of steam engineering. During the Spanish-American war he was chief engineer of the battleship Iowa from beginning to end. He engaged in the bombardment of San Juan, Porto Rico, and numerous bombardments in Santiago, and finally in the fight in which Cervera's fleet was destroyed. He was advanced three numbers in grade "for eminent and conspicuous conduct in battle" and received the medal for the campaign in the West Indies. He was a member of the naval examining board at Washington prior to his elevation to his present distinguished post. His portrait is used this week in our special illustrated supplement.

THE HAPPENING OF THE UNEXPECTED.

Owing to the sudden extinction of the light, due to the breaking down of a power plant recently in New York and the corresponding plunging of a large hospital into darkness, a patient undergoing an operation at that moment nearly lost his life and great confusion was caused among the two thousand patients in the various wards.

When the lights failed there were no facilities at hand for lighting the place by other means, and nurses and attendants were rushed out in a hurry for candles, but little or none could be found. During the half hour of darkness several ambulance calls were received and the stablemen, no better prepared than the others, were forced to get out the wagons as best they could. One surgeon, dressing the wounds of a patient who had just been brought in, managed to finish the task by having one of the male nurses keep lighting matches. The patient undergoing the operation had to be taken from under the influence of ether to save his life, right at the critical part of the undertaking, and his life sustained by hypodermic injections until the light came on again.

How many of our large passenger steamers, depending as they do on electric power for the lighting of the ship, are in any way more prepared to meet with an emergency than this hospital? True, numbers of them there may be equipped with oil lamps and candle sticks, highly artistic in design and beautiful to the eye, but having neither oil in the lamps or candles in the sticks, and probably will remain so till something happens.

Several years ago a liner off her course ran ashore on a rocky part of the south coast of England and sank in a short space of time, many hundred lives being lost. With the striking, or immediately after, all the lights on the ship were extinguished including mast-head and side lights, and to this was attributed the delay in the arrival of a life saving crew from the shore. So runs the tale, and it is the unexpected that happens.

On another liner, working up a dangerous river with numerous twists and turns, shoals and sandbanks, necessitating the constant handling of the engines, a fuse blew out throwing the engine room into utter darkness. Happily, the first assistant engineer kept a couple of hand lamps convenient as a precautionary measure, and these being immediately lit allowed the engineers at the levers to see the signals on the telegraph and work the engines accordingly.

Engineers will admit that it is no uncommon thing for the engine room to be plunged in darkness while under full speed, and remain so till a lamp can be obtained from the stores or boiler room. Meanwhile, the telegraph may ring or some part of the machinery give out, and the engineer would be practically helpless.

Electricity is becoming a more useful and profitable servant day by day, but we cannot put too much dependence on its infallibility, and it is a duty ship owners owe to the passengers and crews on their vessels to see that some provision is made for the day when the unexpected happens.

Capt. Charles Gordon, of Buffalo, whose license as master and pilot was suspended recently by local inspectors at Port Huron, has had his license restored by order of Supervisor-Inspector General Uhler.

APPOINTMENTS OF MASTERS AND ENGINEERS.

	CAPTAIN.	ENGINEER.
NIAGARA TRANSIT CO., N. TONAWANDA, N. Y.		
Str. William A. Rogers	J. L. McIntosh.	William Cunningham
J. O. NESSEN & CO., MANISTEE, MICH.		
Str. F. W. Fletcher	A. E. Anderson	G. M. Hopkins
" Albert Soper	Harry Nelson	P. Mander
" S. O. Neff	John Eble	Winkle
" N. J. Nessen	Christ Edwardson	Joseph Seymour
" Jim Sheriffs	F. D. Richardson	
" J. D. Marshall	A. C. Wanwig	
" Manistee	H. Bennet	George Patterson
" Lizzie Walsh	Capt. Cory	
ARNOLD LINE STEAMERS, MACKINAW ISLAND, MICH.		
Str. Islander	John McCarty	Martin H. Baake
NIPIGON TRANSIT CO., GROSSE POINTE, MICH.		
Str. J. C. Ford	N. L. Morrison	Hubert Manion
QUEBEC TRANSPORTATION & FORWARDING CO., OGDENSBURG, N. Y.		
Str. Florence	W. J. Stitt	O. Fiset
" M. E. Hackett	A. Bernier	
" Orion	J. Bernier	A. Marcotte
Sch. Aberdeen	J. C. Perron	
" F. D. Ewen	A. Monette	
" Zapotec	A. Barre	
E. T. CARRINGTON, BAY CITY, MICH.		
Sch. Allegheny	W. H. Bridges	
DESERONTO NAVIGATION CO., DESERONTO, ONT.		
Str. Ella Ross	D. B. Christie	M. J. McFaul
" Where Now	W. J. Daly	Thomas Timlin
" Reliance	John Gowan	John Toppings
" Arctic	Thomas Millen	William Turner
" Rescue	T. J. Lynch	Owen Flood
" Ranger	Howard Burnip	Arthur Joyce
S. O. NEFF TRANSPORTATION CO., MILWAUKEE, WIS.		
Str. Adella Shores	Sam Holmes	R. S. Nott
LAKE TRANSIT CO., BAY CITY, MICH.		
Str. E. C. Pope	M. H. Mahon	William C. Houston
" Selwyn Eddy	William Greening	Adam C. Lowe
" Penobscot	Forrest Maloney	William P. Hoffman
" City of Bangor	G. D. Tulian	William C. Anderson
LAKE ERIE TRANSPORTATION CO., TOLEDO, O.		
Str. George J. Gould	W. M. Cottrell	Jos. P. Kohlbrenner
" S. C. Reynolds	T. C. Herrick	Antoine Zietler
RICHELIEU & ONTARIO NAV. CO., MONTREAL, CAN.		
Str. Toronto	E. A. Booth	J. Conlin
" Kingston	H. Esford	A. R. Milne
" Brockville	John McGrath	Z. Lacroix
" Prescott	A. Dunlop	J. A. Crepeau
" Montreal	F. X. LaFrance	G. Gendron
" Quebec		F. Gendron
" St. Irenee	Joseph Simard	J. Hamelin
" Tadousac	J. E. Dugal	N. Latulippe
" Murray Bay	A. Fortin	M. Beaudoin
" Chisoutimi	W. Gagne	A. Gendron
" Beaupre	C. Gouin	G. Gagnon
" Berthier	A. Mondor	E. Denis
" Belleville	J. P. Stephenson	W. S. Parker
" Picton	E. C. Redfearn	A. Demartigny
" Hamilton	W. S. McPhee	B. Pintal
" Longueuil	A. Mondville	H. Noel
" Boucherville	A. Laviollette	C. Hamel
" Laprairie	P. McLean	J. St. Michel
" Fire Fly	C. Crepeau	G. Bourret
" Three Rivers	J. Faubert	J. Matte
" Cornwall		C. Hendron
" Rapids King		W. Hazlett
CAPT. JOHN C. PRINGLE, ST. CLAIR, MICH.		
Str. Isabella J. Boyce	John C. Pringle	Charles Schunk
Sch. Iron Cliff	John B. McDermott	
G. A. TOMLINSON, DULUTH, MINN.		
Str. Sultana	William F. Landon	Joseph Cummings
" Sonoma	Harold Davidson	B. St. Bernard
" Sylvania	C. C. Tousley	M. J. McAuliffe
" Sonora	J. T. Weaver	Robert Watts
" Sinaloa	T. A. McDougall	N. P. Slater
" Socapa	Robert McDowell	T. H. Welsh
" Yosemite	George A. Warwick	Victor M. Jarrett
" Saxona	G. W. McCullagh	William M. McCarron
" Hoover & Mason	W. C. Brown	F. G. Carey
" Sahara	Charles Autterson	F. T. Goodwin
" Ball Brothers	E. W. Craine	R. J. Close
" F. C. Ball	W. G. Maltby	A. B. Fortier
" James E. Davidson	Hugh Stevenson	F. McLaughlin
" Sierra	D. P. Craine	William Bridges

CHICAGO & DULUTH TRANSPORTATION CO.

The Chicago & Duluth Transportation Co., Duluth, is the name of a new steamship line that has just been incorporated to operate ships in the package freight business between Chicago and Milwaukee, Sault Ste. Marie, Houghton and Hancock, and Duluth and Superior. The Graham & Morton people, who established a line from Lake Michigan to Lake Superior last season, will withdraw from the latter lake this season and the new company that has just been organized will occupy the field. The new steamship line has chartered the steamers W. H. Gratwick and Alva. Each has a capacity of 4,400 tons and can make the run from Chicago to Duluth, including several stops, in four days. The boats will deliver their freight at the city dock in Duluth. J. O. Nessen of the Nessen Transportation Co. of Manistee, is president and general manager of the new Chicago & Duluth Transportation company; F. W. Prindiville of Chicago, is vice president, and Thomas J. Prindiville is secretary and treasurer. B. L. Burke, who was traffic manager of the Graham & Morton line last year, will occupy the same position with the new company. G. Van Buren of Duluth, will be the local agent of the company.

DREDGE HULL.

The Port Huron Construction Co., Port Huron, Mich., is building a dredge hull 120 ft. long, 43 ft. beam and 11 ft. molded depth. Being of the elevator type of dredge the hull is split down the center for 64 ft. and two large gantries are raised 27 ft. above the deck. Surrounding the main gantry on both sides and across the end will be built columns and frame work for the house while above the house on the starboard side at the forward end will be located the pilot house. Everything will be steel except the fenders. Above the main gantry will be located a smaller gantry to be known as the trolley gantry. This will be 18 ft. above the top of the main gantry.

Frederick L. Muehlhaeusler has resigned his position with the Cleveland & Buffalo line to become general passenger and freight agent of the Lake Shore Navigation Co., which will operate the steamer Eastland between Cleveland, Toledo and Cedar Point this summer.

Muir Bros. & O'Sullivan are the lowest bidders for dredging the mouth of the Black river, Port Huron. The contract will amount to about $12,000.

ELECTRICITY ON STEAMERS

BY H. HENDERSON

There can be no doubt that electric lighting (for that is the principal use of electricity on merchant and small passenger steamers) is a great boon to all on board, and, in the case of passenger boats, can almost be considered indispensable. It is healthy, clean, free from smell or smoke, is quite independent of any motion of the ship, and above all is adaptable to any out-of-the-way position where light may be necessary. For all concerned I think it should be an invariable rule that all steamers should carry an electric lighting plant.

The power required is small, varying, of course, with the size of the ship. The number of lights required may be from 100 to 200 for cargo boats, these numbers representing about 10 to 20 B. H. P. for the engine. Taking an installation of 100 lamps, and assuming that three-fourths of them are used on the average 12 hours a day for 365 days, the coal required would be about 75 tons, or, say, about 4½ cwt. per day, or 5 lbs. per B. H. P. per hour. Such a small amount would never be felt, and even this estimate will probably be found to be high, depending upon the economical use of the lamps and the careful running of the engine. This will be the chief expense of the lighting, as there will be no charge for attendance, since no additional staff need be carried except in large passenger boats, where separate plant and staff are carried for electrical work.

The other costs include oil for engine and dynamo, replacement of lamps and defective fittings.

In describing the installation it will be convenient to take the different sections in the following order: Plant, switchboards, wiring and fittings. All marine engineers should try to gain some slight knowledge of electrical matters. With a good book to read and the ship's installation to follow, an engineer should soon gain sufficient information to apply it in a common-sense way to the work he has to look after. A dynamo is a simple machine to work; at the same time it will not run without attention, but if properly handled should last for years in good condition. For the comfort of all on board and the safe working of the ship it is essential that the lighting should not fail and only a complete shut down can occur if the engine or dynamo breaks down. As a rule boats generally carry one lighting set only, but it is good practice to have two sets, each capable of taking, say, three-quarters of the total load. Then if one machine is entirely disabled, it would be an easy matter to keep the load down to that of one engine by cutting off any unimportant lamps. The type of dynamo generally used is of the two or four pole compound wound machine, preferably partially enclosed to protect the wiring in the armature and magnets from stray splashes of oil or water, the greatest enemies of electrical work. Carbon brushes are generally used, as they give better results than copper gauze-brushes.

The end bearing of the dynamo is fitted for ring lubrication, thus taking the minimum of attention and oil. All dynamos are built for direct coupling to the engine. This method has great advantages in that the space occupied is a minimum, and also dispenses with one bearing, viz., that between the dynamo and engine. With regard to the position of the plant, the bottom or starting platform in front of the main engine is used in cargo boats. This position has the advantage that it is right under the eye of the engineer in charge. If it is a twin-screw boat, the thrust recess forms a very good position. The shaft (unless absolutely impossible) should be placed fore and aft. The armature and shaft are thus not so much affected by the rolling of the ship. Also with the engine aft, the chance of oil and water running on to the armature is very much lessened.

SWITCHBOARDS.—The main switchboard is rather an important part of the plant, as it forms the connecting-link between the dynamo and the lamps. It is also an indicator by which the engineer can tell whether his pressure of supply (voltage) is correct, and whether the dynamo is being overloaded or not. If only one machine is fixed the arrangements are simple. The apparatus should consist of two main switches and fuses, one for each wire from the dynamo terminals. From the fuses connections should be made to two bars commonly called bus-bars. To one of these bars are connected circuit switches and fuses and to the other circuit fuses only. The rest of the apparatus consists of an ammeter for measuring the main current and a voltmeter to indicate the pressure of supply. The whole of the apparatus should be mounted on an enamelled slate panel, and the board mounted on an iron frame, leaving sufficient space behind to allow for connecting up the different wires.

If two dynamos are used, the board becomes larger, but still quite simple. Each dynamo is connected up independently, so that each can take all the load singly, or the load may be divided between them. Owing to a certain peculiarity of compound wound dynamos it requires care to run them coupled together electrically, as would be the best method to do. Therefore, it is safest to arrange the dynamos so that each is independent of the other. The board carries three bus-bars instead of two, and in place of a simple circuit switch, a change-over switch is used so that any circuit can be thrown on to either machine. Of course, it is necessary to have two sets of main cut-off switches and fuses and also two ammeters, one for each dynamo. One voltmeter only is necessary and should be fitted with a switch so that each machine can be tried in turn. If the current falls so that one dynamo could run all the lights in use, then all the switches can be put over the dynamo to be left running and the other shut down.

WIRING.—When electric lighting was first adopted for ship work one of the most controversial points was the system of wiring to be used. There are three systems in use: Double wiring throughout, both lead and return being insulated; double wire throughout, the lead being insulated, and the return acting as a protective covering, and not insulated; single wiring, the lead being insulated, and the ship's ironwork acting as a return.

The first system is that in use on land, and is certainly the best for ship work. The wire generally used is twin wire with wire armouring over the insulation, and in some cases protected with lead covering. Wires leave the circuit terminals at the main switchboard and run to different sections of the ship. These form main distributing wires which terminate in fuse boxes in which are placed branch fuses for the protection of each branch leading to lamps. This box forms a convenient method of connecting up the separate circuits with the main circuit. From the fuse-board run smaller wires to the center (or as near as possible to it) of each group of lamps. These wires are terminated in an extension box, and from this radiate to the different lamps and switches. Thus no jointing is done, which is a great advantage. If any section of wire goes wrong it is easily replaced at a minimum of trouble, requiring no skill, but only a little care to notice where the proper ends of wire are to be placed.

The second system of wiring is very safe, but is troublesome to install and repair. Special fittings are required where any connections are to be made to lamps, switches, etc., as the outer conductor or armouring must necessarily be cut to get at the inner conductor, and

also the outer covering must be securely bridged across to form the return wire.

The single wire system has now almost been abandoned. It has a few advantages, but many disadvantages. Moreover, it cannot be carried out in its entirety, as if the lighting of any panelled cabin is required double wiring must be used, and the return carried to the nearest ironwork. Also in the vicinity of a compass the wires must be doubled. Where it can be carried out it is simple, easily repaired, and faults can be easily traced, since they can only occur on one wire. The trouble arises from the joints with the hull. Any joint between dissimilar metals, with an electric current passing as well, are soon corroded, and a bad connection will result sooner or later.

With regard to fittings, these are generally of the stiff, pendant type, or bulkhead fittings, with heavy glass fronts. For cabin lights, etc., the same type of fittings made in fancy designs is used. These fittings are so arranged that they move solid with the ship, and, therefore, a steady light is maintained whatever the motion.

For mast-head and side-lights special appliances can be obtained to prevent the lights going out through failure of lamps. Some are designed to advise those in charge by ringing a bell and indicating on a special instrument that a lamp has gone out. Perhaps the simplest is the double filament lamp, with two separate filaments, both in use. If one goes, there is still a reduced light from the other. Upon, say, a periodical examination, this fault can easily be remedied, and the lamp used in a less important position.

General Maintenance.—With regard to the general maintenance of the installation it will be well to mention a few important points which are likely to occur. The dynamo should need little looking after if ordinary care is used. The commutator will give most trouble, chiefly from sparking. On no account should sparking be allowed to continue. If it cannot be done away with, then it may be from the following causes: (1) Wrong position of brushes, which can be remedied by revolving them round the commutator until the correct position is found. (2) Sparking may occur from a fault on the armature or a disconnection in the coils. This can only be repaired by removing the armature and repairing the damaged coil. This fault should not occur under all ordinary uses, but it is preferable to carry a spare armature. (3) From flats or unevenness on the surface of the commutator. This might be got over by filing and the use of glass cloth if not too bad. If it is badly burned then the only satisfactory remedy is turning up in a lathe; or by a tool rest rigged up on the bedplate. (4) By insufficient contact between the brushes and commutator. This can usually be adjusted by altering the whole brush holder or by adding pressure to the brush only. Care should be exercised in this matter, and the pressure kept to a minimum. Heavy pressure is unnecessary and means wear of commutator and brushes.

It is important that all connections are kept tight, especially in the magnet circuit, as a break in this is a dangerous matter.

Attention to the switchboard is a small matter. Probably the switches will be rarely used under current, and if any burning does take place it is easily taken off with a file and glass cloth.

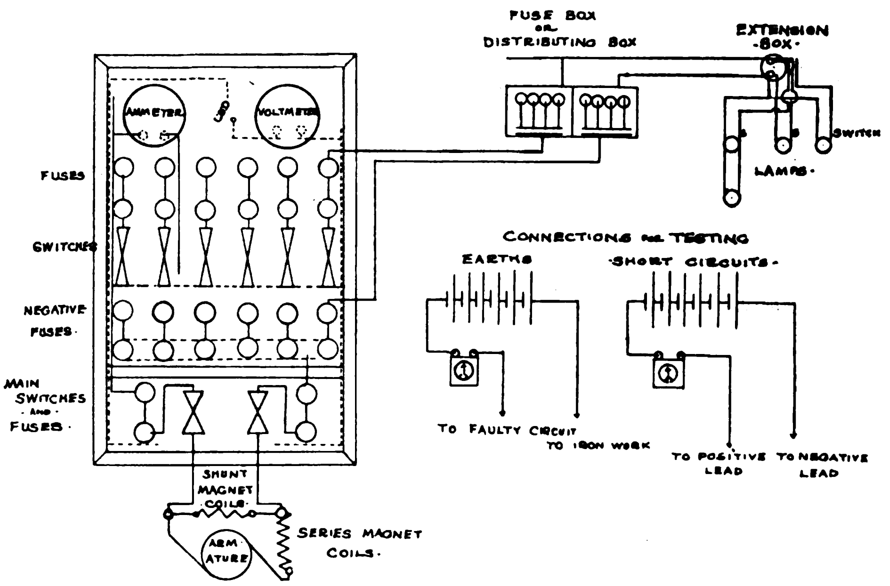


DIAGRAM OF SWITCHBOARD AND CONNECTIONS.

The principal maintenance on the circuits will be the renewal of the lamps and occasionally a fuse, if faults should occur. The tracing of a fault is an easy matter in circuits where disconnection of any part is so easy. Assuming that a fault has occurred, the circuit upon which it is can be traced from the switchboard. The next step would be to draw all the fuses in the distributing box on the circuit and again test. This would show whether the mains were right. Next each branch could be tried from the box and the faulty branch further disconnected at the extension box, and so on until the fault is found. System must be employed in looking for a fault, and by starting at the beginning of the circuit and working to the last branches any fault either to the earth or ironwork, or between lead and return, can soon be found. A few cells and a galvanometer or detector are all that is necessary and can easily be handled. Tests should be made each morning when shut down.

The attached diagram shows a switchboard and one circuit complete with lamps, etc. Also a diagram of connections for testing either for faults to the ironwork or faults between lead and return.

ITEMS OF GENERAL INTEREST.

Fire Commissioner Francis J. Lantry, of New York city, has awarded contract to Alex. Miller & Bro. for the construction of a fire boat to be 102 ft. in length. Two other fire boats are also being built for the city by the same firm.

Construction at Bath, Me., includes two vessels; the G. G. Deering Co. is constructing a 1,400-ton four-masted wooden schooner, and the Kelley-Spear Co. will soon launch the dredge which it is building for C. M. Cole, of Fall River, Mass.

The Cunard Steamship Co. has declared a dividend of five per cent and after writing off for depreciation the usual amount, has carried $600,000 to the insurance fund and $250,000 to the reserve fund, leaving a balance of $270,000 credited to profit and loss account.

A successful trial trip of the new wrecking steamer Helen M. Field took place recently. The vessel is 160 ft. in length, 28 ft. wide and 12 ft. 6 in. deep. She has double fore and aft compound engines of 700 H. P., built by James Reedy & Son, Baltimore, and there are two 10 x 12 Scotch boilers.

A bill was recently introduced at Albany to authorize the construction of a water gate and monument to Robert Fulton, inventor of the steamboat. It provides for the extension of Riverside park in the city of New York, by the filling in of lands now under water, and the erection of the monument on the land so made.

NEW PARTNERSHIP FORMED.

Considerable interest will doubtless be manifested along the chain of lakes over the announcement that Mr. W. I. Babcock, of New York, and Mr. Henry Penton, of Detroit, formed a partnership under the firm name of Babcock & Penton, consulting engineers and naval architects, with offices at No. 814 Perry-Payne building, Cleveland, and No. 17 State street, New York. Both of these gentlemen are too well known to need any introduction to the interests associated with lake trade. It was Mr. Babcock who originated the mold system of vessel construction under which all the vessels on the great lakes are now being built. He founded the Chicago Ship Building Co. and continued as its president and general manager until it was purchased and consolidated with the other yards of the American Ship Building Co. in 1899. Latterly, he has been engaged in important work on the coast where his activities have covered a wide range in design. Mr. Penton was associated with him at the Chicago yard as chief engineer and later occupied a similar position with the Great Lakes Engineering Works, of Detroit.

MR. W. I. BABCOCK.

FREIGHT SITUATION.

Considerable surprise was manifested among vessel interests this week when the steamers Wm. A. Rogers sailed from Lorain and the Charles Weston from Toledo for the head of the lakes. Mr. Mills is, in their opinion, a venturesome soul. None of them is disposed to follow his lead, but all of them will watch the progress of his vessels with close attention. Last year the Rogers opened navigation by making the Lake Michigan trip, but at this particular time a trip to Lake Superior is altogether another story. The straits were at that time fairly free from ice, as they are now, although there is considerable floating ice to be encountered; but the ice in St. Mary's river is solid and how the Rogers and Weston are to fare when they reach that portion of their trip remains to be seen. The ordinary bulk freighter is not an especially serviceable ice crusher. Two years ago, upon false information, a fleet of nearly 100 vessels started out, only to be frozen in in Whitefish bay at a loss, including repairs and operating expenses, of about $3,000 per vessel, or $300,000 for the lot. Owners that were involved have not forgotten that experience and have issued orders to their masters not to leave port until the passage can be safely made. There is good reason for conservative action this spring, owing to the ship yard strike with its inevitable delay in making repairs.

When the season opens it will be unusually active with freights ruling somewhat higher than last year. The coal rate has already been marked up on wild cargoes and grain has advanced ⅛ cent.

Insurance rates have been advanced from 4⅜ per cent to 4½ per cent, with the added provision that losses must exceed $500 before the underwriter is liable.

LABOR CONFERENCES.

A number of labor conferences will be held within the next two weeks. Owing to the fact that quite a number of divisions of labor entered last year into two years' contracts, the important question of hours and wages will not come up. The dock managers are meeting with the representatives of the Longshoremen's association this week and are adjusting minor grievances. No conferences have as yet been held with labor aboard ship, but the executive committee of the Lake Carriers' association will meet the delegates of the Firemen, Seamen and Cooks' union next week. The delegates of the International Dredge Workers' Protective association are now in consultation with the dredge operators. This conference is quite important as the question of an eight-hour day is involved. The government dredges work upon an eight-hour basis, but not all the work that the private dredgers do is government work, and the operators feel that the uniform application of the eight-hour day would work a hardship to many.

MR. HENRY PENTON.

A NEW MAMMOTH WHARF CRANE.

There has just been completed in Britain at the works of Messrs. Armstrong, Whitworth & Co., at Elswick, a new 150 ton hydraulic crane. This is the largest of its kind and has been constructed for the purpose of putting heavy machinery in a completed condition into battleships and other vessels lying alongside the wharf. The main lifting power is in two parts, each capable of raising 75 tons separately, or 150 tons when worked together. The lifting range is 100 ft. and the maximum rake or radius jib is 117 ft. At this rate 25 tons can be lifted, and 150 tons can be lifted at a rake of 99 ft. When carrying the latter weight, the height of the jib head sheave above the jetty is 166 ft. The crane makes a complete circle. The range in lifting is through a height of 10 ft., and the range in turning is unlimited. Carried on piles, the crane is mounted on steel pedestal, with archway through it, so that the traffic on the jetty is uninterrupted. The crane has taken the place of the old 120 tons sheerlegs which were erected at the Elswick ship yard in 1876.

150-TON HYDRAULIC CRANE AT ELSWICK.

BRIEF NOTES.

According to a New York morning paper recently, a fire was extinguished on an incoming steamer by "boring a hole in her bottom with the removal of a stopcock."

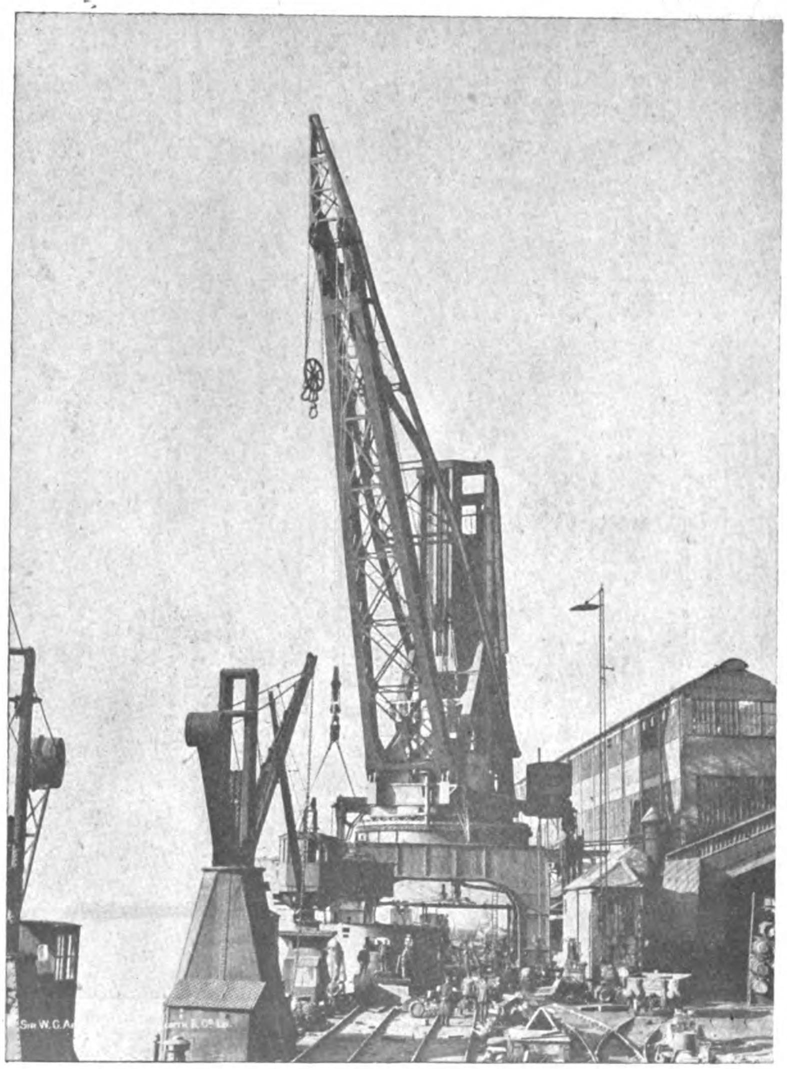
A new Staten island enterprise is about to be established by Lewis Nixon, at Tottenville, consisting of a ship yard which will be devoted especially to the construction of motor boats similar to the one built by Mr. Nixon and sent to Russia during the late war. It is reported that the plant will be on a very large scale.

The department of docks and ferries of the city of New York is at work on the bulkhead for the new ferry slips at Pier 3, East river, the foundations and floor timbers having been laid and dredging for slips being in progress.

The steamer Charles Rietz, which had the honor of opening navigation between Cleveland and Detroit, last week, will be converted by her new owner, M. A. Callahan, into a sand sucker. She was purchased from Burns Bros., Detroit.

There were docked at the Morse yard, New York, recently the following vessels: Spartan Prince, Saxon Prince, Hornby Castle, Lewis Luckenbach and Amstel for painting and repairs and the army transports Kilpatrick and Meade for a general overhauling.

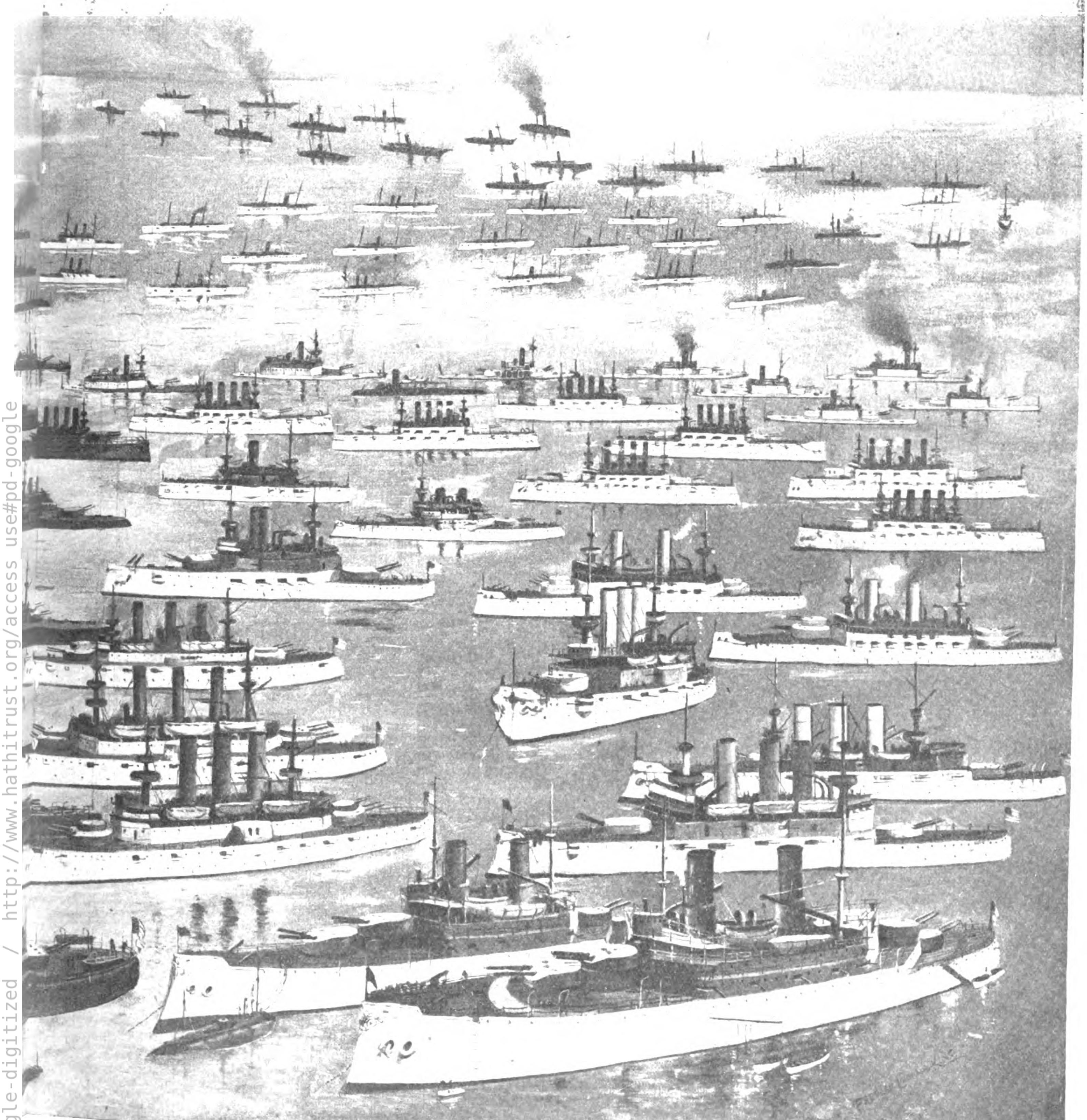
The Manhattan Electrical Supply Co., 17 Park Place, New York, has just put out a catalog descriptive of the electrical equipment carried by it. The catalog covers a wide range as is indicated by its title, "Something Electrical for Everybody."



150-TON HYDRAULIC CRANE AT ELSWICK.

Reproduced from original drawing by permission New York Times.

IN THIS VALUABLE PICTURE ARE ASSEMBLED ALL THE NAVAL BUILDING. IT IS ACCURATELY DRAWN FROM PH



ʼAVAL VESSELS OF THE UNITED STATES EXCEPTING THOSE NOW
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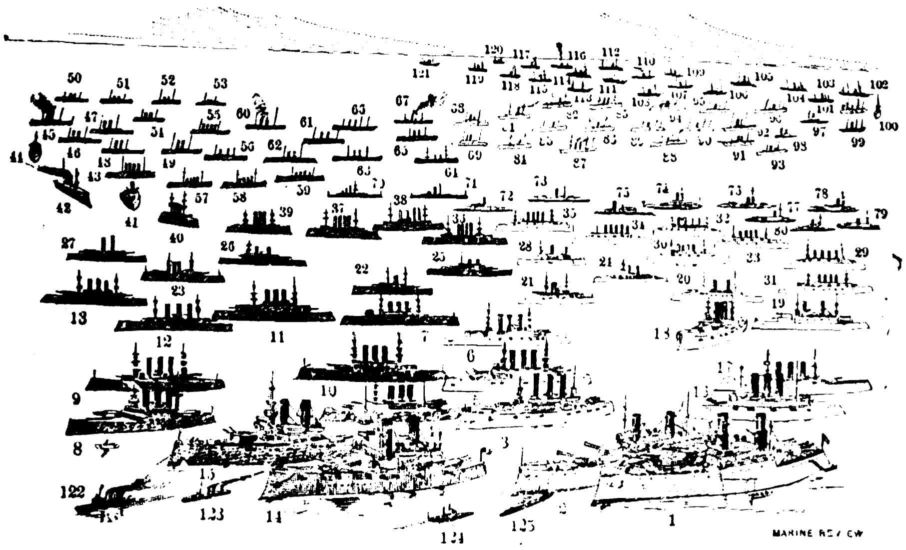


KEY TO UNITED STATES NAVAL PICTURE.

BATTLESHIPS.—1. Michigan. 2. South Carolina. 3. Virginia. 4. Georgia. 5. Nebraska. 6. Rhode Island. 7. New Jersey. 8. Connecticut. 9. Louisiana. 10. Kansas. 11. Minnesota. 12. Vermont. 13. New Hampshire. 14. Idaho. 15. Mississippi. 16. Maine. 17. Missouri. 18. Ohio. 19. Kentucky. 20. Kearsarge. 21. Alabama. 22. Wisconsin. 23. Illinois. 24. Indiana. 25. Massachusetts. 26. Oregon. 27. Iowa. 28. Texas. ARMORED CRUISERS.—29. Washington. 30. Tennessee. 31. North Carolina. 32. Montana. 33. Colorado. 34. West Virginia. 35. Maryland. 36. California. 37. South Dakota. 38. Pennsylvania. 39. Brooklyn. 40. New York. CRUISERS.—41. Charleston. 42. Milwaukee. 43. St. Louis. 44. Denver. 45. Chattanooga. 46. Tacoma. 47. Des Moines. 48. Galveston. 49. Cleveland. 50. Raleigh. 51. Cincinnati. 52. Detroit. 53. Marblehead. 54. Montgomery. 55. Colombia. 56. Minneapolis. 57. Salem. 58. Birmingham. 59. Chester. 60. Baltimore. 61. Newark. 62. Olympia. 63. Albany. 64. New Orleans. 65. Chicago. 66. San Francisco. 67. Philadelphia. 68. Boston. 69. Atlanta. COAST DEFENSE.—70. Arkansas. 71. Wyoming. 72. Florida. 73. Nevada. 74. Meantonomah. 75. Monadnock. 76. Monterey. 77. Terror. 78. Puritan 79. Amphitute. 80. Yankee. 81. Yosemite. 82. Prairie. 83. Dixie. 84. Topeka. 85. Buffalo. 86. Reina Mercedes. GUNBOATS.—87. Yorktown. 88. Concord. 89. Bennington. 90. Paducah. 91. Dubuque. 92. Vesuvius. 93. Nashville. 94. Petrel. 95. Bancroft. 96. Wilmington. 97. Helena. 98. Vicksburg. 99. Princeton. 100. Newport. 101. Annapolis. 102. Castine. 103. Machias. 104. Wheeling. 105. Marietta. 106. Dolphin. 107. Mayflower. 108. Mindano. 109. Vixen. 110. Gloucester. 111. Don Juan de Austria. 112. Scorpion. 113. Isla de Luzon. 114. Isla de Cuba. 115. Hist. 116. Alvarado. 117. Sandoval. 118. Callao. 119. Sylph. 120. Michigan. 121. Type of Destroyer. 122. Type of Torpedo-boat. 123. Lake Submarine. 124. Holland Submarine.

REVENUE CUTTER FOR PUGET SOUND.

Bids will be opened in the treasury department on April 4 for the building of a single-screw steamer for the Revenue Cutter service on the north Pacific coast. The principal dimensions of the steamer will be: Length over all, 152 ft.; length between perpendiculars, 139 ft. 6 in.; breadth of molded beam, 29 ft.; depth 17 ft. 6 in.; her displacement to mean draught of 12 ft. 4½ in. above base line, with 125 tons coal and 11,000 gallons of water, 794½ tons.

The machinery installation will consist of one triple-expansion engine, having high-pressure cylinder 18 in., intermediate cylinder 29 in,. and low-pressure cylinder 47 in., with a stroke of 30 in., operating under a steam pressure of 180 pounds. When making the maximum number of revolutions per minute, an indicated horsepower of about 1,200 is to be obtained.

All shafting and engine rods will be forged of mild open-hearth steel, the crank and thrust shaft having a diameter of 9 in., the propeller shaft to be 9½ in. driving a four-bladed-built propeller 11 ft. in diameter. The condenser will have a cooling surface of 1,657 sq. ft.

Her auxiliary machinery will consist of one main feed pump of the double-acting duplex type, with steam cylinders 8 in. in diameter, water cylinders 5 in. in diameter, 12-in. stroke, the auxiliary feed pump having the same dimensions. One fire and wrecking pump, designed for heavy service, with steam cylinders 14 in. diameter, water cylinders 8½ in., 12-in. stroke. An independent twin-cylinder air pump, and independent centrifugal pump, complete the main pumping machinery, the usual bilge, sanitary, distiller-circulating, and evaporator pumps being also installed.

An evaporating and distilling plant with a capacity of about 1,700 gallons per 24 hours, and a feed-heater of approved design with about 120 sq. ft. of heating surface, will also be in the engine room.

The boiler installation will consist of one single-ended Scotch, and one water-tube boiler, of an approved type, the dimensions of which are: Scotch boiler, diameter, 13 ft. 6 in., length, 10 ft. 3 in., having three furnaces 40 in. in diameter, with a grate surface of 60 sq. ft., and a total heating surface of 1,803 sq. ft. Water-tube boiler, length, 19 ft. 4 in., width, 12 ft. 9 in., height to center of drum, 13 ft. 3 in.; length of tubes, 9 ft.; total grate surface, 78.5 sq. ft.; total heating surface, 2,565 sq. ft.

The valve gear will be of the Stephenson type with double-bar links, all valves being worked direct. The valve stems will be made of class B steel forgings, the intermediate and low-pressure stems being fitted with balance pistons, all the valve stems being interchangeable. The valves on the high-pressure and intermediate cylinders will be piston valves, the low-pressure valve being a double-ported slide valve. The machinery is to be fitted throughout with metallic steam packing.

The usual trimming and fresh water tanks, water-tight bulkheads and doors, are required. Bilge keels 12 in. deep will be fitted and will extend for about 60 ft. amidships. Mounts for one-pounder guns will be fitted, one on each side of the bridge; mounts for a line-throwing gun will be fitted where directed. A general alarm system will be installed, the gongs being of U. S. navy pattern, situated at wardroom, engineroom, and crew space.

Her complement of boats will consist of two 24-ft. metallic lifeboats, Ingersoll patent self-righting, one 20-ft. otter boat, one 16-ft. dingey, and one 17-ft. metallic life raft. The boats are to be fitted complete with sails, and all necessary rigging.

A complete electric light system of 15 kilowatt will be installed, together with searchlights, signaling apparatus, etc. A wireless telegraph apparatus, located in a room made sound proof with canvas-covered cork will also be installed.

The deck machinery will consist of the usual steam steering engine, windlass, and steam gipsy.

QUESTIONS FOR MASTERS AND MATES.—NO. 35.

511. What is the cause of transient induced magnetism?

512. What is induced magnetism?

513. What kind of iron produces induced magnetism?

514. What kind of deviation does induced magnetism produce?

515. Give a case of induced magnetism on board ship?

516. What is meant by adhesive attraction on the compass?

517. How is it caused?

518. What kind of deviation does hard iron produce?

519. What kind of deviation does soft iron produce?

520. How would you counteract the effects of deviation due to hard iron?

The new Stapleton terminal of the Staten island ferry, which is being erected at a cost of $137,000, is rapidly approaching completion. A new ferry house will be constructed at a cost of $125,000 additional. There will be a machine shop, coal pocket, ash dump and oil house adjoining, the plan being for a general lying-up place for the municipal ferry fleet.

AWARDED MEDAL.

The McArthur Portable Fire Escape Co., of Cleveland, was awarded a medal at the first international exposition of safety devices held by the American In-

stitute of Social Service recently in New York. Both sides of the medal are reproduced in the accompanying engravings. The portable ladder which the institute has endorsed is a convenient device for a variety of uses. It is especially adapted for use aboard ship. The

cables are of galvanized wire, the steps of aluminum, and the hooks of bronze. The ladder is so light that it is perfectly practical to carry one in a suitcase. It is certainly superior to the ordinary rope ladder used aboard ship, as it is possible even for a child to use it.

STEEL SCOW LAUNCHED.

The launching of the big steel scow, building for the Empire Engineering Corporation, at the yard of the Empire Ship Building Co., Buffalo, last week, was attended with unforeseen circumstances. The steamer City of Genoa, which is being repaired at the Empire yard, was directly in the way of the launching and was moved a considerable distance. Her stern, however, projected in such a way as to shut off the vision of the launching ways from vessels going down the Erie basin. The White Star line tug Peckham was going down the basin and was about amidships of the Genoa when the scow was launched being christened successfully by Miss Grace Wilson Clark. The plight of the Peckham was seen immediately after the scow was released from the ways and hundreds of persons shouted a warning. Capt. Joseph Green, of the Peckham, did all he could to save the tug, but could not avoid impact. The scow hit the Peckham on the starboard side, tearing away more than half of the pilothouse, smashing her rail and breaking several stanchions. Fortunately no one was hurt.

DULUTH HARBOR.

Gen. Alexander Mackenzie, chief of engineers, has appointed a board of engineers to make re-examination and survey of Duluth harbor and entrance thereto, for the purpose of recommending such improvements as may be best suited for the harbor. The board consists of Col. Henry M. Adams, Buffalo; Col. Charles E. L. B. Davis, Detroit; Major James G. Warren, Cincinnati; Major Henry Taylor, New London, Conn.; Capt. Harry Burgess, Louisville, Ky.; First Lieutenant Arthur Williams, Cincinnati. This doubtless means the reopening of the entire Duluth controversy.

DAKOTA A TOTAL WRECK.

Cablegrams from the orient indicate that the Great Northern liner Dakota which went ashore on Osani reef off the Japanese coast is a total wreck. The latest reports are that her main mast, mizzen mast, funnel and cabin are under water. Of her cargo of 6,720 tons of freight and 299 bags of mail only 5 per cent has been saved.

Judge Hazel, of the United States District Court of Admiralty at Buffalo, has handed down a decision reducing from $15,000 to $5,000 the verdict in the case of Della B. Sweeting, of Jackson, Mich., against the steamer Western States.

NATIONAL ASSOCIATION OF MARINE SUPPLYMEN.

The MARINE REVIEW, in the February Engineers' number, contained a group picture of the representatives of the National Association of Marine

CHARLES W. MARTIN JR.

Supplymen in session at Washington, D. C., during the convention week of the Marine Engineers Beneficial Association.

The accompanying photographs are

MR. JOHN L. MCGILVRAY.

of Chas. W. Martin Jr., chairman, (whose photograph did not appear in the group), and John L. McGilvray, secretary-treasurer, the officers elected for the ensuing year.

TURBINE VS. RECIPROCATING ENGINE RESULTS.

Only four battleships, three armoured cruisers, and two torpedo boats were passed through their steam trials during the year by the British admiralty whereas in the previous year there were thirty-four vessels—nearly four times the number—and these included one battleship, eight armoured cruisers, a protected cruiser, eight scouts, and sixteen destroyers. This comparison might suggest a relaxation in our effort to maintain our naval supremacy; but last year was exceptional in one respect, this year in another. Last year there were included six Devonshire cruisers which had been delayed owing to a commendable increase in the gunpower when the vessels were far advanced towards completion, and the great number of destroyers fell within last year owing to delay consequent upon a change of opinion as to the type of craft, the heavy river class having been preferred to the 30-knot boats, which became "suspect" owing to the Cobra disaster. This year we have only two torpedo craft, because development in opinion, after due consideration and experiment, favors light and exceptionally high-speed craft with express boilers using oil fuel and driven by turbine machinery. These changes involved delay; but now boats are following each other in rapid succession. The two boats tried this year are of the 26-knot type, now to be called first class torpedo boats instead of coastal destroyers. They are a distinct success, easily realizing their 26 knots speed for less than 4,000 horsepower, and the lower consumption of fuel, quite 40 per cent less than with the earlier craft, gives them, for the same weight of fuel, a much greater radius of action. In a few months we shall have the trials of the first of the new 33-knot boats, which are of 800 tons, and have turbine machinery of 15,000 I. H. P.—an enormous power for such light craft.

Of the battleships tried three were of the King Edward VII. class, and the fourth was the much-discussed Dreadnought. The results of the trials of the former may first be dealt with, as they throw light upon the significance of the performance of the latter, and it may be well to tabulate the data for all eight ships of the King Edward class, as basis for deduction regarding the later ship and the name of the constructor of the machinery—the Commonwealth, Dominion and Hindustan were also built by the engine contractors; the other ships were of Dockyard origin. It will be noted that on the low-power trial Fairfield got the lowest consumption; on the three-fourths trial Messrs. Humphreys, Tennant & Co., are lowest with the Britannia, and Vickers have the lowest result for full power. The three last ships on the table were those tried this year, and one of these, the Africa, was engined by Messrs. John Brown & Co. Ltd., Clydebank.

RESULTS OF STEAM TRIALS OF EIGHT BATTLESHIPS OF KING EDWARD VII. CLASS.

	1-5th Power.	¾th Power.	Full Power.
King Edward VII. (Harland & Wolff)—			
Coal consumption...	2.63 lb	1.96 lb	2.17 lb
Water consumption.	20 lb	16.3 lb	17.7 lb
I. H. P...........	3,760	12,844	18,138
Commonwealth (Fairfield Co.)—			
Coal consumption...	1.73 lb	1.67 lb	1.83 lb
Water consumption.	......	16.77 lb	18 lb
I. H. P...........	3,663	12,797	18,562
Dominion (Vickers)—			
Coal consumption...	1.93 lb	1.68 lb	1.77 lb
Water consumption.	21.6 lb	18.4 lb	18.3 lb
I. H. P...........	3,889	12,843	18,438
Hindustan (Brown, Clydebank)—			
Coal consumption...	1.94 lb	1.75 lb	1.8 lb
Water consumption.	20 lb	17.5 lb	18.3 lb
I. H. P...........	3,718	12,929	18,521
New Zealand (Humphrys)—			
Coal consumption...	2 lb	1.88 lb	2.1 lb
Water consumption.	......	......	......
I. H. P...........	3,979	12,981	18,440
Africa (Brown, Clydebank)—			
Coal consumption...	2.00 lb	1.79 lb	1.87 lb
Water consumption.	......	......	......
I. H. P...........	3,682	12,860	18,698
Britannia (Humphrys)—			
Coal consumption...	2.05 lb	1.50 lb	1.83 lb
Water consumption.	21 lb	16.21 lb	18.55 lb
I. H. P...........	3,539	13,087	18,725
Hibernia (Harland & Wolff)—			
Coal consumption...	2.07 lb	1.59 lb	1.92 lb
Water consumption.	19.9 lb	17.41 lb	19.66 lb
I. H. P...........	3,710	12,700	18,112

The machinery of this vessel was fitted with a system of forced lubrication, which gave most satisfactory results, and the Dreadnought has since had the same method of lubricating the bearings applied. In this respect, as in others, the turbine machinery offers great advantages. Instead of analyzing the results given in the table in detail, it may be preferable to note the averages. On the one-fifth trials of the eight ships the mean consumption of fuel was 2.04 lb. of coal per indicated horsepower per hour, and in the Dreadnought the corresponding figure was 2.56 lb. The working of steam turbines at a proportion of their full power is expensive; the best results are got by excessive or over-load. It is true that the Dreadnought, like all warships, has special turbines of small power for cruising, but even these cannot be always worked at full power when the speed of the ship varies. It must be borne in mind, too, that the power of the Dreadnought was reckoned at the shaft instead of in the cylinders as in the other vessels, and about half the difference is thus accounted for. Only in five of the vessels was the water consumption taken. At one-fifth power the results showed a steam consumption of 20.5 lb. per I. H. P. per hour. This includes the consumption of the auxiliary machinery, the power of which is not considered in arriving at the result. A point of special interest is that on the Britannia a trial at one-fifth power was made with steam superheated to the extent of about 100 degrees F. On this test the coal consumption was 1.77 lb. instead of 2.05 lb. in the table, and the steam consumption was 18.19 lbs. instead of 21 lb. This justifies the application of superheaters in some of the new turbine-equipped battleships. On the three-fourths trial the average coal consumption of the eight ships in the table was 1.72 lb. per indicated horsepower per hour, while in the case of the Dreadnought the result was about the same, 1.7 lb.; but if allowance is made for the difference due to the method of taking of power the economy in favor of the turbine ships is quite 10 per cent. On the full-power trial the economy of the turbine is still more marked. The coal consumption here was in the Dreadnought 1.51 lb.; the mean in the eight King Edwards was 1.91 lb., and no account is taken in the latter of power lost in friction. Practically the whole of this economy is due to the turbines, the boiler evaporation being on an average about 10 lb. of water per pound of fuel. The steam consumption of the machinery in the Dreadnought at three-fourths power was 17.01 lb.—about the same as in the King Edwards—and on the full-power trial 15.56 lb., as compared with from 17.7 lb. to 19.66 lb. in the reciprocating engines on the King Edward battleships.

The three cruisers tried this year were the Cochrane, built at Fairfield; the Natal, constructed by Vickers; and the Achilles, built at Elswick. These belong to the Duke of Edinburgh class, of 13,550 tons displacement; the Prototype and the Black Prince were tried last year. The sixth vessel, the Warrior, also Dockyard built and engined by the Wallsend Slipway & Engineering Co., will go on trials in January. The five vessels already tried had an average coal consumption at one-fifth power of about 2 lb., the Elswick ship coming out lowest, and the Duke of Edinburgh, engined by the same firm (Hawthorn, Leslie & Co., Ltd.), highest; at three-fourths power the average was 1.92 lb., and at full power 2.06 lb., so that it will be recognized from a comparison of these results with those for the Dreadnought that with an arrangement of cruising turbine more suited to the variable speed of ships, or a determination to limit the range in speed in peace to a specific rate for cruisers, the turbine

machinery may be more economical at all required powers as it is at higher powers. And this advantage will be increased when the steam is superheated. Owing to the vessel having different propellers the speeds varied as the following table shows:

POWER AND SPEED RESULTS OF TRIALS OF ARMORED CRUISERS.

Ship.	One-fifth power. I. H. P.	One-fifth power. Knots.	Three-fourths power. I. H. P.	Three-fourths power. Knots.	Full power. I. H. P.	Full power. Knots.
Cochrane	4,911	14.3	16,080	21.37	23,664	23,292
Natal	4,913	14.13	15,937	21.11	23,592	23,334
Achilles	4,882	14.69	16,009	21.58	23,968	23.5
Duke of Edinburgh	5,039	14.4	16,903	21.1	23,685	22.84
Black Prince	4,879	14.6	16,699	21.51	23,939	23.65

The Achilles full power speed was taken by bearings, and not on the measured mile; but even so the variations prove that more data are required to solve the propeller problem, and it is satisfactory to know that the technical officers at the admiralty are addressing themselves to this subject with that ability and courage which has so completely characterized their progressive work in recent years.

CO-OPERATIVE AND PROFIT SHARING PLAN.

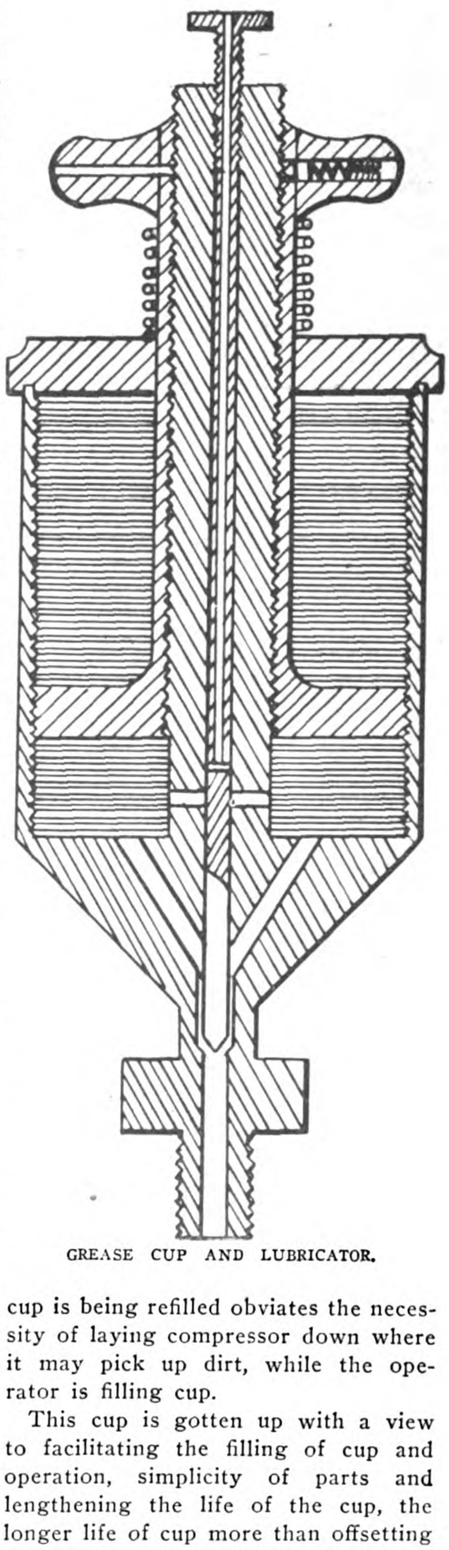
The Republic Belting & Supply Co., Cleveland, manufacturers of leather belting, have adopted a co-operative and profit sharing plan of conducting its business which, it is believed, will meet with much favor among its employes. Because of the large increase in its business and the necessity for more capital, this company recently decided to increase its capitalization from $100,000 to $300,000 and to sell $150,000 worth of 7 per cent preferred accumulative stock at $85 per share. Of this $150,000 the company allotted $100,000 to its employes, allowing each to take as many shares as he was willing to pay $1 per month per share for. The factory employes, office force and salesmen have already subscribed for $101,000 of this stock.

In addition to selling its stock to employes, to make them interested in the profitable handling of the business, the company has decided to give a Christmas present to its employes every year, each employe getting as many per cent of his salary as he has been years in the employ of the company. For example, under the profit-sharing plan, an employe will be presented with 1 per cent of his salary at the end of his first year, two per cent from the second year and so on up to six years. After an employe has been with the company six years he will get as a present each year 6 per cent of his first year's salary. This profit sharing plan applies to all employes except the salesmen, who are paid a commission on all sales, starting with the first dollar's worth sold. This commission ranges from ¼ to 2 per cent.

The company has adopted another plan of co-operation in addition to the financial interest in order to provide the maximum efficiency of the organization. Each sales department is managed by one person, who is chairman of a committee of three to five salesmen in his department. The general sales manager keeps in close touch with each department. The manufacturing end of the business is divided into four departments, with a foreman of each department as chairman of a committee of three to improve the quality of goods in his department or the efficiency in handling. All the foremen in time become members of a committee of which the superintendent is chairman with the idea of developing the factory organization as a whole. This committee meets once a week for general discussion. Any weak points that may develop are discussed at this meeting and steps are taken to rectify them. This plan imposes responsibility upon a great many and at the same time centers it in a few.

GREASE CUP AND LUBRICATOR.

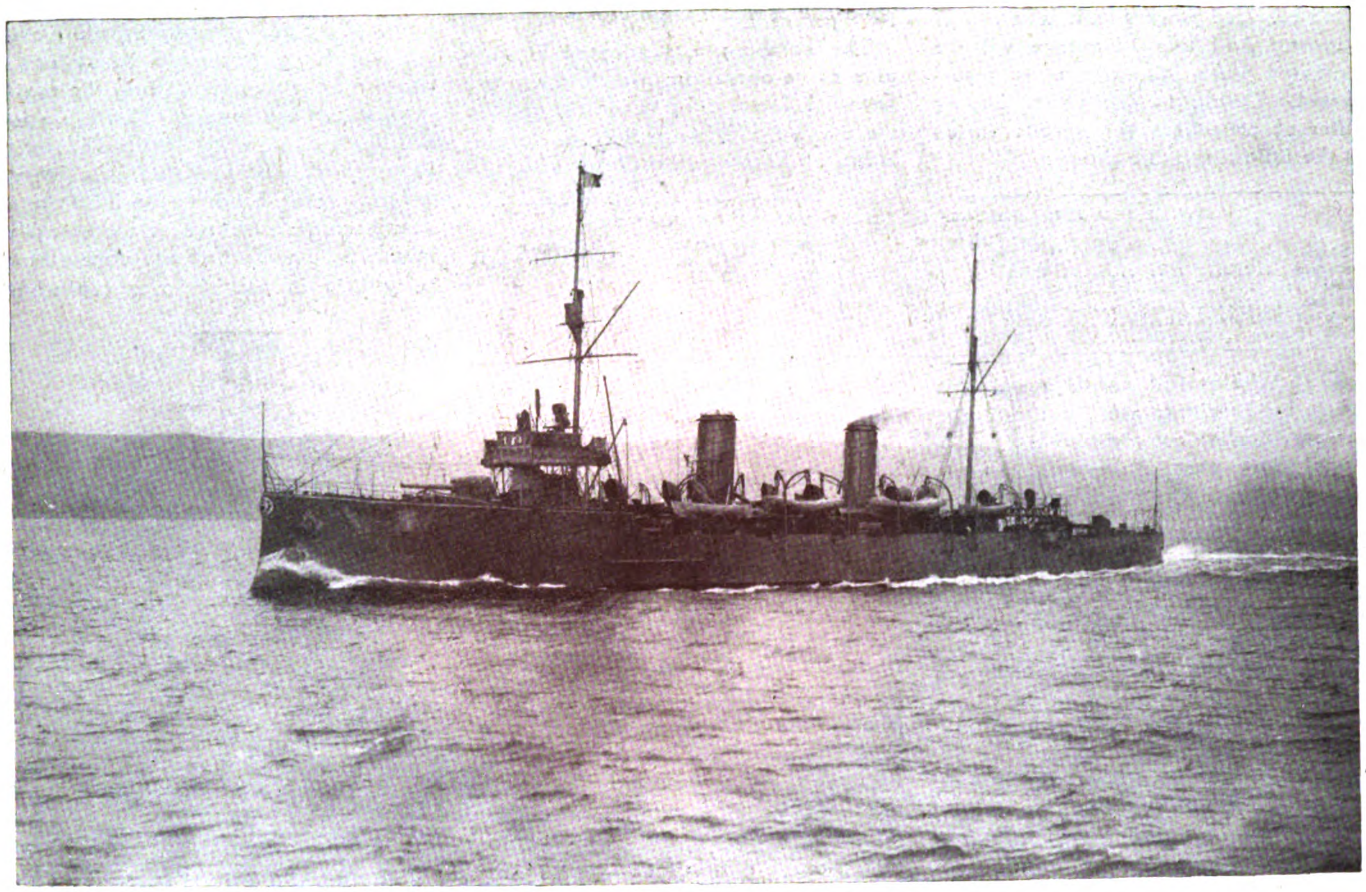
The grease cup and lubricator invented by George W. Ingham, of Sault Ste. Marie, will probably be welcomed by the engineering fraternity. Engineers and others familiar with the lubrication of machinery, know the annoyance caused by finding on removing the compressor of a grease cup, whose position had indicated the cup was empty, to find it (the cup) half full of grease. This, of course, is caused by the grease flowing up from passage in journal or bearing into the vacuum caused by the upward movement of the compressor. The cup invented by Mr. Ingham has, as is shown by sketch, two different appliances for remedying this difficulty, first the needle valve (which also serves as a controller when using oils) can be turned down to its seat, and positively prevents the backward flow of lubricant up into the cup. On turning compressor up to refill cup, the compressor remains in engagement with supporting element and forms a protecting cover while the cup is being filled, and as the supporting element in center is threaded to guide compressor in mesh with body of cup this takes away all danger of cross-threading and spoiling body of cup, or losing compressor by letting it fall into the moving parts of machinery. This is a special feature on ships that make long voyages without stopping machinery, as convenient handling of lubricating gear becomes a source of considerable moment. The fact of the compressor being held in position over cup while



GREASE CUP AND LUBRICATOR.

cup is being refilled obviates the necessity of laying compressor down where it may pick up dirt, while the operator is filling cup.

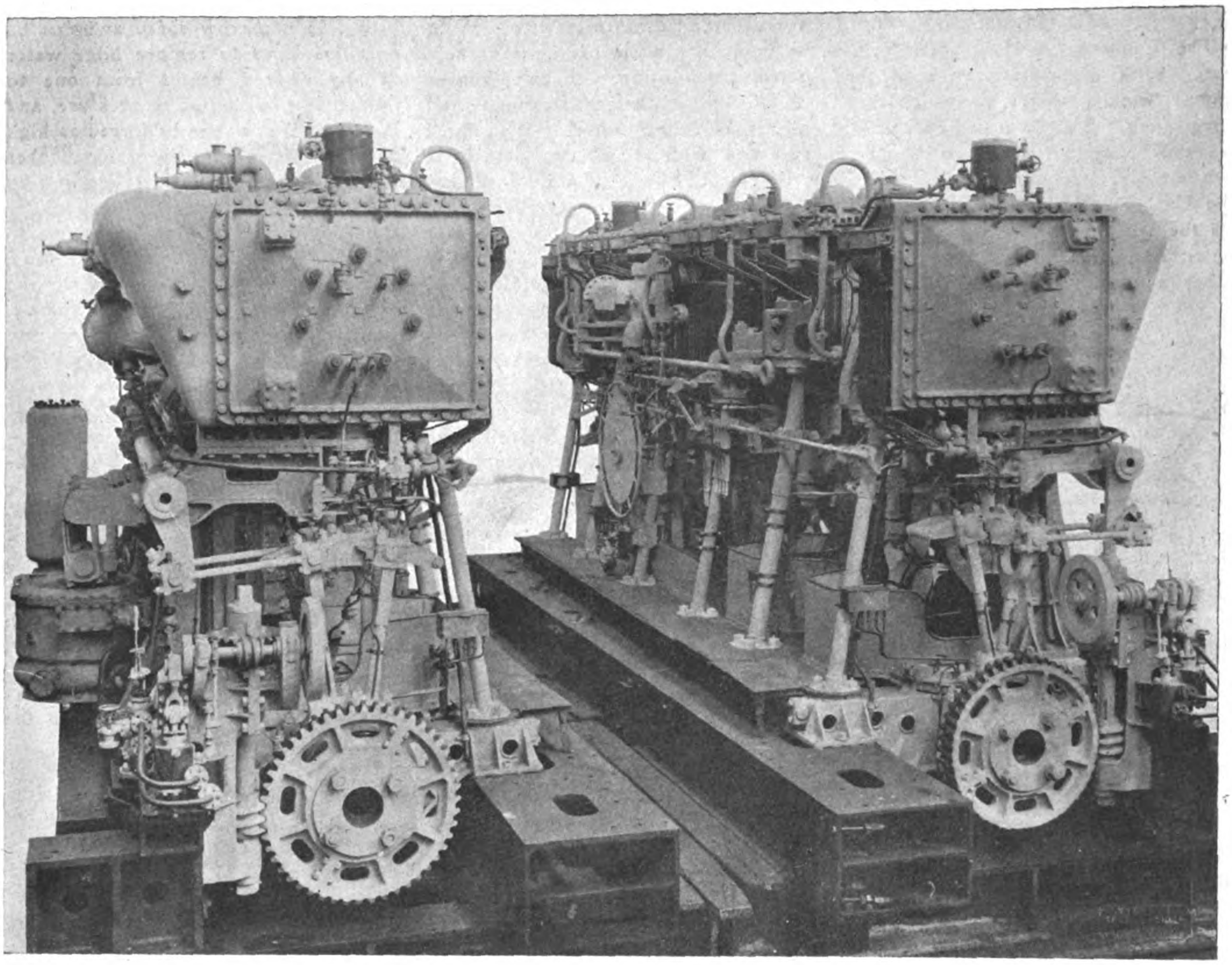
This cup is gotten up with a view to facilitating the filling of cup and operation, simplicity of parts and lengthening the life of the cup, the longer life of cup more than offsetting the few cents cost of manufacture of parts necessary.



PERUVIAN CRUISER CORONEL BOLOGNESI

PERUVIAN CRUISER CORONEL BOLOGNESI.

The trial trip of the cruiser Coronel Bolognesi, the second vessel of this type built for the Peruvian government, by Messrs. Vickers Sons & Maxim, of Barrow-in-Furness, affords some interesting details of the developments of the scout class, or the "eyes of the fleet." The cruiser has a length of 370 ft., a breadth of 40 ft. 6 in., and a draft of 14 ft. 3 in., which will enable her to enter most of the harbors in South America. On this draft the displacement will be about 3,200 tons. The machinery consists of two sets of four-cylinder triple expansion engines, each set having four cranks balanced on the Yarrow-Schlick-Tweedy system. They are designed to give a collective i. h. p. of 14,000, with a steam pressure of 250 lbs. per square inch at the engines, and 280 lbs. at the boilers. This will give a speed of 24 knots, and the coal endurance at cruising speed will be about 4,500 sea miles. The ten boilers of the small tube type are arranged in three separate water-tight compartments, and at full power will work under the closed stokehold system of forced draught. The vessel has a complete equipment of auxiliary machinery. The cruiser, notwithstanding the limitations in size and cost, is effectively protected, as there extends a deck of 1½ in. thickness for the full length of the vessel, so as to cover in, not only the magazines and steering gear, but also the boiler and machinery compartments. Extensive coal bunkers are arranged along the sides in the wake of the machinery space, so as to minimize penetration by shot and shell. The conning tower forward, from within which the ship will be controlled, and fought, is constructed of nickel steel hardened armour 3 in. thick. As regards the armament, there is a 6 in. gun, with an armour shield on the forecastle deck forward and one on the upper deck aft. The service of ammunition and projectiles to these guns has had careful consideration in order to give them the maximum rapidity. Electric motor ammunition hoists of the dredger type have been fitted, and these are protected by armoured tubes. The secondary armament consists of eight 14-pounder quick-firing guns, and eight 1¼ pounder guns, distributed principally on the broadside on the upper deck and bridges. There are two submerged tubes for firing 18-in. torpedoes. The cruiser has thus features which will commend her to such naval powers as Peru, where the expenditure of the navy is necessarily limited, as the vessel combines with exceptionally high speed of 24 knots a considerable armament, including two weapons firing a 100-lb. shell at a velocity effective against unarmoured craft at three miles range. While thus able to engage such craft, she will, with the assistance of the high speed, greatly harass armoured slower ships, and will at the same time, create those diversions which when practiced even by relatively weak fleets, naturally influence the strategic plans of a superior force. The vessel has also many qualities insuring the comfort of the officers and crew in the variable climate of southern seas. She will have a total complement of 300 officers and men, and the living quarters are more comfortable than usual in such small craft. The vessel is provided with refrigerating plant and ice-making machinery, with cold storage chambers adjoining, and the bakery is equipped with mechanical dough kneaders. Again the vessel is fitted with hammock berthing instead of rails, and the stowage of the hammocks within these adds to the protection against machine gun fire, as was almost universally the case in vessels for the British navy a few years ago. There is fitted an installation of wireless telegraphy. The Coronel Bolognesi carries two powerful searchlights, and nine small boats are carried including a 34-ft. steam launch.



ENGINES OF PERUVIAN CRUISER CORONEL BOLOGNESI.

MISCELLANEOUS ITEMS.

Stewart & Co., Chicago, will build the new 800,000-bu. elevator for Perot & Co., Buffalo.

Capt. W. J. Colwill and others of Sarnia have bought the barge Sophia Minch from Capt. James Sheehan, of Detroit.

The steamer W. J. Gordon, formerly running between South Haven and Chicago has been sold to W. S. Shaw, of Boyne City.

The Oceanic Steamship Co. has decided to discontinue its Australian service in which it has hitherto employed the Ventura, Sierra and Sonoma.

Herbert B. Walker, who was elected president of the Old Dominion line this week, began as office boy with the company twenty years ago. He is thirty-eight years old.

The Hamburg-American Line has purchased the four steamers of the Robert Sloman Line, the Guthrune, the Gunther, the Siegmund and Fieglinde, plying betwen New York and Brazilian ports.

The steamers Henry Holden and America are undergoing repairs at Milwaukee. Fifteen plates are being taken off the Holden and the America is having twenty-one plates placed on her bottom.

The steamer Sierra, built during the winter by the Toledo Ship Building Co., was delivered to Mr. G. A. Tomlinson this week. She will load coal for Duluth.

The Hamburg-American line steamer Valdivia, which recently received so much damage by the explosion of her donkey boiler, is at the Erie basin, New York, for repairs.

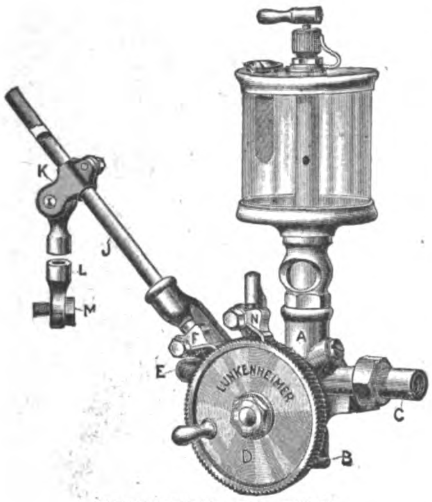
Mr. T. F. Newman, general manager of the Cleveland & Buffalo Transit Co., and Frank Kirby, naval architect, examined together the plans of the new Cleveland & Buffalo liner this week. The new steamer will be 475 ft. long and 97 ft. over guards, being therefore about 25 ft. longer and 6 ft. wider than the new D. & C. line steamer which will come out next July. The ship builders will be invited to submit bids within a day or two.

Mr. Henry H. Curwen, of the Fore River Ship Building Co., visited the great lakes region recently to make arrangements to take the three whaleback barges, Bombay, Baroness and Bay City, to the coast. As they are too long to pass through the locks of the canals their noses will be cut off and put together again at some ship yard on the St. Lawrence. These barges together with nine others were sold to the Boutelle Steel Barge Co. by the Pittsburgh Steamship Co. two years ago.

Details of the plan by which the Merchants & Miners Transportation Co. absorbed the Boston & Philadelphia Steamship Co., owned by the New York, New Haven & Hartford railroad, and the last named corporation acquired an interest in the Merchants & Miners company have just been published. The New England Navigation Co., which operate the water lines of the New York, New Haven & Hartford railroad, agreed to purchase $2,500,000 par value of the capital stock of the Merchants & Miners company and to deliver in payment $2,000,000 par value of the New York, New Haven & Hartford railroad stock.

AN IMPROVED MECHANICAL OIL PUMP.

The Lunkenheimer Co., of Cincinnati, O., is the manufacturer of the pump illustrated herewith, which they have given the trade name of Marvil. As will be seen, the driving mechanism is of the ratchet type, operated by the clutches that work co-operatively by the motion of the rod, which can be attached to the eccentric rod, or other moving parts of the engine by



MECHANICAL OIL PUMP.

the couplings shown. The motion thus obtained is transmitted to the piston by the crank pin mechanism seen on the rear view of illustration. The ratchet wheel is provided with a handle whereby it can be rotated by hand in case it is desirable to force a quantity of oil at any time as for example, in starting the engine.

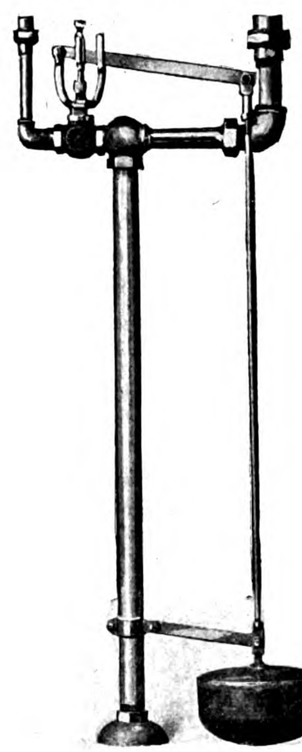
The coupling on the rod may be moved up or down, thus lengthening or shortening the stroke of the pump, and regulating the amount of oil fed by the pump, independent of the feed from the oil cup. Joints of the cup are tight, the sight-feed glass being packed so as to prevent access of air that would have a tendency to cause the cup to feed after the engine had ceased running. This feature, and use of check valves in the pump prevent wastage of oil supply. The feeding of oil is automatic, i. e., starting and stopping with the engine.

The outlet is connected to the steam pipe or engine valve chest and a spring check valve, supplied with the pump, should be placed in this connection as near as possible to the point of entry into the steam pipe or chest. The bottom of the pump body is tapped with ⅝-in. bolt thread to receive a stand, so that it can be placed wherever desired. All parts are made to jigs and templets, and are therefore, easily renewed and interchangeable. The ratchet wheel, pawls, shaft and yoke are made of tool steel, tempered and hardened. All other metal parts about the pump are made of the very best bronze composition. Each pump is carefully tested before shipment, and satisfaction is guaranteed. It is listed with and without oil cup, but it is usually supplied with the Lunkenheimer No. 6, one pint capacity, "Sentinel," snap lever, sight-feed cup, and so sent unless otherwise specified. The filling hole is of large area so as to fill easily, the cup is also fitted with a strainer and hinge cap which cannot be lost. This pump is also made with double feed and for traction engines, or where a heavy oil is to be fed, the pump is supplied with a compression oil cup, the oil being forced to the pump by means of a spring actuated plunger in the cup.

Where pressure systems have been installed the pump is equipped with a Lunkenheimer Reserve pressure oil cup, a combination giving perfect satisfaction wherever used.

THE BRAENDER BILGE SYPHON.

The Braender bilge syphon shown in the illustration is an automatic device for keeping the holds of vessels in a dry condition. The advantages



BRAENDER BILGE SYPHON.

of a dry hold are well known and to know how to maintain a vessel in such condition, at a merely nominal cost, is worth much to every ship owner and marine engineer.

The Braender bilge syphon can be placed in a narrow space and can be so adjusted as to remove bilge water at any desired height from one to twelve feet, with 50 lbs. pressure, and if desired it can then be forced as high as 30 ft. As soon as the water reaches the height at which it is desired to be removed, the pressure exerted by the float instantly opens the valve to full area and steam is given full sway, causing a vacuum and drawing the bilge water at once to the syphon, whence it is discharged at the rate of 1,500, 2,000 or 3,000 gallons per hour, according to the size syphon used. When on the point of stopping the valve closes easily and automatically and its action is not disturbed by the rocking of a vessel.

Simplicity of construction and operation, and reliability of action, coupled with a nominal cost for installation and maintenance commends this device to the service of ship owners and mariners everywhere. Those desiring further particulars should communicate with Philip Braender, 143 W. 125th street, New York city, who is the sole maker.

TRADE NOTES.

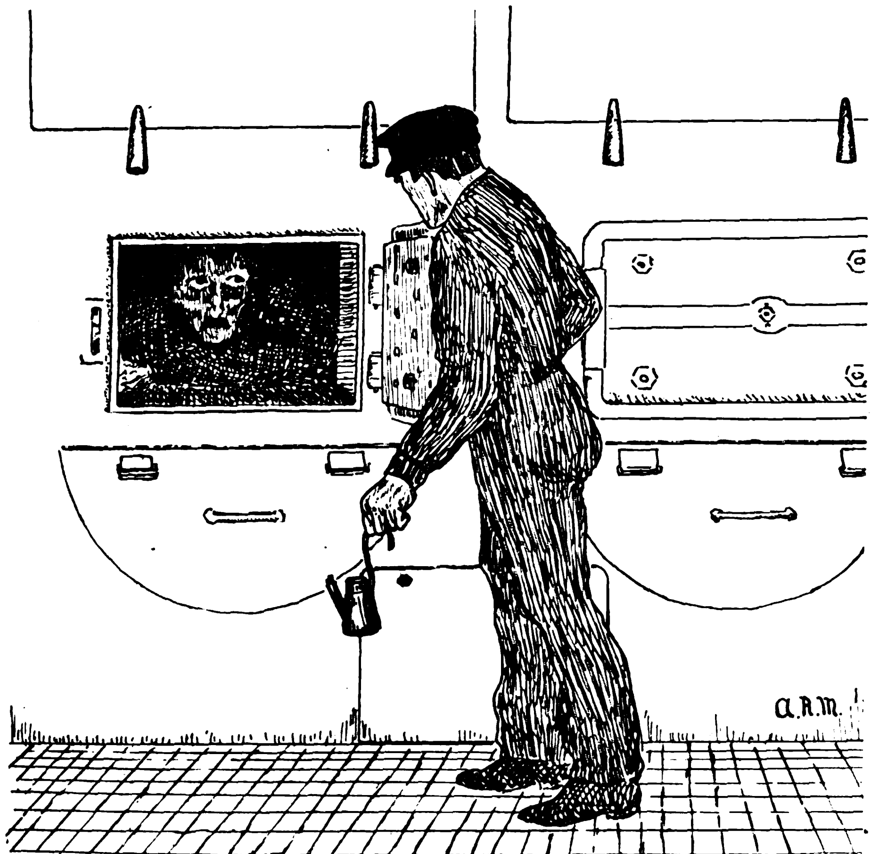
The A. J. Beckwith business, dealers in dry goods, carpets, etc., has been purchased by H. F. Bugbee, who was with the above company for eleven years, and H. P. Moore, who has been with the Higbee Co., of Cleveland, and will be operated under the name of Bugbee & Moore. They have for years made a specialty of furnishing supplies to the marine trade.

The United States Metallic Packing Co., 429 North Thirteenth street, Philadelphia, Pa., has just issued a little booklet descriptive of metallic packing for stationary engines. The packing described in the catalog is known as Class No. 1 Design, which has been found easily adapted to all classes of service and an efficient, economical and satisfactory packing in every way. This packing is in use on the main engine piston rods and valve stems of many new ships of the United States navy which have come out within the last few years. It has also been standard on many well-known trans-Atlantic, coastwise and lake steamers for many years. The catalog is well illustrated and will be sent to anyone interested.

The Detroit & Cleveland Navigation Co. has issued a folder announcing the opening of its service. The folder contains exterior and interior drawings of the new steamer City of Cleveland.

"IN THE MERCHANT SERVICE"

To begin at the beginning, the Third of the Glaswegian had been having a look around the donkey-house for stray lamps, and opened a furnace door in the boiler in his search. The boiler had not been used for some time, the ship was twenty-four hours at sea, so the Third could be excused for giving a poorly-suppressed start when he saw two eyes, part of a blackened face, peering at him from the interior of the furnace. It was a question which of them was the more surprised. Finding a stowaway is no rare occurrence, but usually unexpected.



"IT WAS A QUESTION WHICH OF THEM WAS THE MORE SURPRISED."

"Come along, beauty," said the Third as he reached for the collar of his prize, "come along with me to the higher tribunal."

The stowaway clambered out of the furnace, not at all sorry that his place of concealment was known, shook the dust and ashes from his clothes, and followed the Third to the chief's room, where he underwent the usual cross-examination. He was a German, had never been in the states, was willing to work, had no clothes on board or friends amongst the crew (they never have), and was reconciled to the fact he would have to go back with the ship to Liverpool, where he could look forward to a month in dungeons deep.

The deck department was duly notified and the incident entered in the log, but as the engine department had witnessed the horrible sight of a belated fireman engaged in mortal combat with the shore police as the ship pulled from the wharf—said fireman having spent his few remaining hours ashore in accumulating a farewell jag—they decided to put the stowaway to work in the bunkers.

In a case of this kind it was customary to make the stowaway work his passage, out and back, keeping him locked up while the ship was in New York. His escaping from the ship and getting clear away means a fine of $500 to the shipping company. So they had to be careful.

It was the usual wintry passage, dirty weather most of the way, but the stowaway worked faithfully through it all. Each watch he toiled on, filling the ash bags under the hoist and getting the full effect of the seas coming down the ash shute. He had comandeered the services of the deserter's bunk and blanket, and with some of the Third's discarded clothing had managed to make himself fairly comfortable.

All was well till the day and hour arrived for handing him over to the deck department for safe keeping, the morning of the day the ship was to dock, when it was found that he had disappeared. Yes, he had skipped.

Then there was trouble. A quiet search was inaugurated and the bunkers thoroughly searched, but as there were only three searchers and the bunkers were on three decks and about twenty in number, not to mention the fact that the searchers' lamps betrayed their presence to any one wanting to keep out of their path, it wasn't a very satisfactory examination. The boiler tops next underwent a scrutiny, as did also the boiler spaces, and various lockers. They even crawled along under the boilers with two inches of water washing about the tank tops, but with no more success.

At breakfast time the news was gently broken to the chief who, after the usual cursory remarks turned out the full staff of engineers to join in the search, a number of whom had decided not to have any breakfast as they couldn't have it in bed, and now wished it when they couldn't get it. They mustered the men on deck and searched the fo'castles, a guard being stationed at the door later to note all who passed in or out. The decks were searched, as they suspected that the stowaway had dressed himself with some outside help and every lifeboat was examined.

To make matters worse, the crew commenced taking an active interest in the search and volunteered all sorts of information, particularly the fact that the stowaway had been seen to wash and dress in a white shirt and shore clothes. As it was strongly suspected that some of them knew of the whereabouts of the stowaway, having been very friendly with him during the trip, little faith was put in their advice. And still the search went on.

At quarantine the steerage passengers mustered to pass the doctor, the opportunity being taken of thoroughly examining the steerage quarters. Their man was neither in the steerage or with the passengers. From the quarantine station to the dock the searchers were at fever heat, one zealous junior engineer stopping a sailor to glance suspiciously into a paint drum he (the sailor) was carrying along the deck.

The ship swung into the dock, the gangways rolled into position, and the

usual hurry and bustle attending the arrival of a big liner commenced. The passengers began pouring down the gangways, quite unaware that they were being closely scrutinized by the engine department of the ship.

Down in the boiler rooms a host of men were hard at work drawing the fires and quenching the flames with buckets of water. There was the usual clouds of blinding vapor and ashes and general uproar that accompanies this operation. The men in the engine room were swarming over the machinery, "wiping down" preparatory to knocking off, when a weary bedraggled figure was seen to emerge from the boiler room door and run to the well on deck. Having drank several deep draughts of water the figure made for the gangway, to be told that none of the crew could go ashore till the passengers were off. His suspicious actions and general appearance (he had his coat on and was dripping with sweat) made the electrician, who was on deck, suspicious. Though unaware of the identity of the stowaway he took chances on a guess, and after a question or two took the man along to the chief.

It was the stowaway and the search was over. Seemingly he had been concealed behind a boiler, somewhere, how long, they couldn't find out, and had stuck to it to the last gasp, but the drawing of the fires had been too much for him. His famished appearance was his salvation, as he was hurried off to the lock-up before any of the search party laid hands on him. The search had lasted eight hours.

THE "STAND-BY" MAN.

A. D. 2007.

(Being a tragedie of the lakes in four acts.)

BY JAMES ROSSAN.

Dramatis Personae.

One Chief Engineer. (Must be absolutely bald, and the possessor of an abnormally large cranium.)

Four stokers. (Must have pretty figures and be slender and willowy. The present day chorus girls would serve best for this purpose).

One young lady.

One old man.

Passengers, stewards, laborers and scullions, etc.

Scene—Lake Erie.

Act 1.

Scene—Showing interior of a ship moored at the dock in Cleveland.

Enter the four pretty young stokers, swinging jauntily aboard.

First stoker—This is an exceedingly pretty ship.

Second stoker—I am especially in love with the white and gold decoration of this pretty stokehold.

Third stoker—And the rich tapestries and furnishings.

Fourth stoker—Not to speak of the oriental rugs and downy couches.

All stokers (in chorus)—This is a jolly ship!

Enter the chief engineer, through the silken curtains separating the engine-room.

Chief engineer—Gentlemen, you may now start the conical tubes generating. We depart immediately.

All stokers (bowing deep, and with perfectly modulated voices)—With pleasure, sir.

Enter passengers and others, and the ship departs.

Act 2.

Scene—Engineroom of ship out on Lake Erie. A terrific storm is lashing the lake. The seas run mountains high, and the spindthrift is thrown toward the heavens. But not a motion of the ship is perceptible, and seated comfortably among the silken cushions is the chief engineer.

Enter the old man, perturbation written on his face.

Old man—Now is confusion abroad.

Chief engineer—(Ignores him).

Old man—Show me to the captain.

Chief engineer—Ah, my friend, it must indeed have been long since you traveled by the water routes. We discarded those long ago.

Old man—Who guides the ship?

Chief engineer—You will observe here at my elbow a small curiously wrought box. This is what we call the electro-magno steerer. This little invention has at all times control of the ship, and is absolutely infallible. Before departing the true course of the ship is marked out and placed in the box, and nought can swerve the ship one thousandth part of an inch from that course. Of course this instrument was not practical until we discovered the terrific force of multiple-magno-dynamics which we generate in series of conical tubes and utilize as our propulsive power. With this modern mode of driving the ships they can not variate one fraction of a second in speed no matter what the condition. Consequently with the speed problem solved, the guiding of them became easy. And thus was the whole problem of safe navigation solved by eliminating the factor of human fallibility.

Old man—And I perceive no motion from the waves.

Chief engineer—Oh, the matter of steadiness was easy to overcome. These ships are built of the new metal called allusteel. It is lighter than cork and stronger than steel. With the weight as a whole so greatly reduced it was easy to provide trimming-tanks in which the water automatically follows the wave-lines on the outside of the ship thereby doing away with all rolling or pitching.

Old man—It is very, very wonderful.

Act 3.

Scene—Same as in second act. Storm still raging.

Enter a large steel freighter, ramming the passenger boat amidships, and plowing her way to the very center. There is crunching of metal and flying of sparks. All is confusion.

Enter old man (tearing his hair).

Old man—Woe is me! Woe is me! All's lost. We have collided!

Chief engineer—Calm yourself, all's well.

Old man—But we shall sink. O, horrors of the sea!

Chief engineer—Sir, with this button I have just closed the compartment where the collision occurred. The ship is constructed on the cellular plan from top to bottom, with automatic arrangements for trimming. Though we had a dozen such collisions they would not harm us the least. And though we were cut entirely in two by some monster each separate part would remain perfectly seaworthy.

Enter young lady, dressed in the height of the fashion of the times.

Young lady—Sir, I have observed the collision, and I think it was perfectly lovely.

Chief engineer—I am glad you enjoyed it.

Young lady—Oh, it was grand; such beautiful twisting of metal into the most fantastic shapes, not to speak of the pyrotechnics and the curious sounds. I am sure I should enjoy another.

Chief engineer—We are always willing to accommodate our passengers when within our power to do so.

Young lady—This is a jolly ship.

Old man—These are jolly times.

All (in chorus)—These are jolly times for the travelers.

Act 4.

Scene—The ship is laying at her dock showing an ugly rent in the port side. The passengers have long since departed. The time is 5:30 a. m.

Enter chief engineer.

Chief engineer—Now do we heal the wounds. Bring on the thermo-tubes.

Enter first stoker.

First stoker—All the compliments of the morning to you, sir.

Enter second stoker.

Second stoker—In compliance with your request, sir. (Here he passes to the engineer a long curious contriv-

ance which sparkles and sputters like the very fountain of heat. A number of laborers are seen heaping large blocks of metal into the wounded side of the ship. These the engineer touches with his magic wand, and immediately they dissolve. He then traces out channel-bars, angle-irons, beams and plates; the metal following his wand not unlike the melted solder following a tinker's iron).

Enter third stoker.

Third stoker—It is done.

Enter fourth stoker.

Fourth stoker—And now is our ship as good as new.

Chief engineer—We sail at six.

All (in chorus)—We sail on time, with our ship as good as new. These are jolly times on the waters.

Curtain.

SEEN AND HEARD IN THE ENGINE ROOM.

Though we have almost forgotten the Maine, the Larchmont and the Slocum are still remembered.

To declare that steamboat inspection is necessary is simply an admission of the obvious; and to state that steamboats are now really being inspected is only a declaration of the unvarnished truth.

In the spring many an owner of an obsolete craft's fancy lightly turns to thoughts of fitting out.

But the fitting out to be done this spring must be strictly according to the rules and regulations of the steamboat inspection service.

And inspectors are leaving a wake of condemned boilers on account of the owners' penny wise and pound foolish policy of installing frying pan-like boilers in staunch craft.

There is the case of the steam lighter Thomas; within the year she has 3 times exchanged her old water tube boiler for an older, or, at least, a worse one.

Now just ask any unemployed fireman, or deckhand, for that matter, "Do you want a job on the Thomas?"

You may receive an answer in the affirmative from a greenhorn, but the "regulars" are sure to decline on the ground that the boat's boiler is not likely to last long enough to give them a chance to make a week's pay. But wait till the inspectors board the Thomas and they we'll probably have the same program as during the inspectors' entertainment on board the steam lighter Elizabeth W. Washburn a few days ago.

The Washburn's boiler was condemned; it being found that said boiler had the appearance of a veritable scarred campaigner with its numerous patches—both "hard" and "soft."

Incidentally, let it here be remarked that a "hard" patch is riveted and a "soft" one bolted on.

Of the so-called "soft" variety of patch no use can be made within the fire zone, or fire range.

Also, engineers claim that the deplorable condition of the Washburn's boiler was due to the great influx of grease from the condenser.

"But, gentlemen, why did more grease accumulate in this particular boiler than in others?"

And a chorus of engineers replied: "The Washburn has no filter box."

A large tow boat company recently decided to invest in a new tug. The head of the concern then interviewed the oldest engineer in his employ with a view to ascertain the latter's choice between a surface and a keel condenser.

"Boss," said the engineer, "I'll give you all the points and then you may pay the price as well as make your own choice."

"If you wish to save both space and the price of a circulating pump, by all means let us have a keel condenser."

"A keel condenser consists simply of about three copper pipes fitted snugly alongside the keel."

"As these pipes are thus surrounded by water (the harbor water) no circulation pump is needed."

"But here is a hypothetical question: What are you going to do when you are hardly moving (when ahead of a long tow, for instance) and the 'circulation' water, that is, the water surrounding the pipes" is getting hot?

"You cannot send a diver down to act as a circulating pump by waving his sombrero through the water in the vicinity of your keel condenser."

"Remember also, Boss, that should the tug run aground most, if not all, of the boat's weight comes to rest on that condenser—and then even if the whole contraption is not put out of commission the pipes are certain to leak."

"My advice is: invest in a circulation pump, and though a surface condenser takes up rather much room cram one in some corner where I can get at it when it feels out of sorts."

"Anyhow, that is more than I can do in the case of a condenser snuggled up against the keel."

"I hear they are going to try turbine engines in a small tug," said the engineer of a steamlighter.

The man addressed had been for years chief on all kinds and conditions of harbor craft, and his answer was: "Don't you believe it."

"You know," he continued, "that large marble factory in Harlem?"

"A 15-inch by 6-foot stroke Corliss engine did all the factory's work, and did it easily and well." "And only 2 cylindrical boilers were needed to supply the necessary steam.'

"Then the fame of the turbine spread north of the Harlem river; and the outcome is that now the work of the factory is being done by one of Parson's turbines."

"I'll not go so far as to say that the latter engines cannot do the work; but —there are now four instead of two boilers needed to supply the steam, and when last our lighter tied up along the factory's pier there was some mention of adding a fifth boiler to the collection."

Ever since the motor boat show one has heard predictions about the increased number of gasoline propelled craft likely to be seen during the coming summer.

But tugboat and steamlighter engineers all give it as their opinion that gasoline can never displace steam.

And these engineers, in proof of their contention, cite the case of an oil company which operates two gasoline boats—the Tiptop and the Magic Safety.

This company's idea was to save, besides the coal and water bill, the expense of hiring a fireman.

Now it is claimed that the oil company's gasoline bill makes the cost of operating the two boats prohibitive.

Recently the tug Raymond, of the Dalzell fleet, sank while tied up to her Brooklyn dock.

The cause of this particular tug's sinking has not been stated, but one engineer declared that on several occasions tugs have been sunk through carelessness on the part of some member of the crew.

It appears that after a deckhand, for instance, has placed the nozzle of the fresh water hose into the tank, he (the deckhand) often remembers an appointment he has with some friend in a nearby saloon.

It is especially at such a time that time flies, and so does the water into the tank.

Presently a deckhand, loaded to the brim, returns to a boat in a similar predicament. F. H.

The Fore River Shipbuilding Co., Quincy, Mass., have been awarded the contract for a steel derrick lighter for use in Boston harbor by the New England Navigation Co. The dimensions of the lighter are: Length over all, 130 ft.; beam molded, 30 ft.; extreme beam, 30 ft. 6 in.; depth molded, 13 ft. 6 in. The lighter is to be complete and will be used for a first class freight and towing steamer.

SMOOTH ON.

Mr. S. D. Tompkins, president of the Smooth-on Manufacturing Co., Jersey City, N. J., recently delivered an address before the Modern Science club, Brooklyn, N. Y., on the subject of Smooth-on. He said:

It is not my purpose to make an address to you on the subject of iron cements. Only a plain talk on the uses, adaptability and method of application of smooth-on iron cement. It is a metallic, atomized iron in a compound that hardens when saturated with water and thoroughly kneaded into a compact homogeneous mass and put into a hole, crack or small crevice fills it with iron that lays up to the surface so close that the slight expansion of the cement forces it into the grain of the iron.

It is useful for mechanical purposes. Its first use was principally for covering blemishes and sometimes to conceal faults in iron and steel castings. And it was often misused, as the temptation was to cover faults in poor foundry work. Today foundrymen find it better practice to cover blemishes and not faults. While we don't believe it best to publish every repair that is made to an engine, boiler or machine, we cite a few cases that we know can do no harm to anyone. Sometimes we hear it said that the use of smooth-on iron cements is only a makeshift. That it only serves as an expedient, adapted to serve a present need or turn. A temporary substitute. We will answer this as follows: When the seven million gallon centrifugal hydraulic pump in the New York navy yard collapsed, with a crack 20 ft. long and it was ascertained from the makers of the pump that it would take 26 weeks to procure duplicate castings to replace the broken parts, it was suggested by the engineer in charge who had used smooth-on cement successfully, that he believed he could repair it with this cement and permission was given. It was repaired successfully in three days and worked during the past six years. This makeshift saved thousands of dollars and made a reputation for mechanical skill for the engineer in charge that subsequently put him in charge of one ot the largest manufacturing plants in this country with a corresponding increase in salary. This use paid owner and employe and was a permanent repair. There were two such repairs made in the New York navy yard.

We could recite a hundred other instances where important repairs have been successfully made to pumps.

One particularly difficult boiler patch on the circumferential seam of a marine boiler patch was 7 ft. long and 10 in. wide. It had been put on in the usual way with white and red lead and iron filings without success. We suggested that it could be repaired with smooth-on cement, and we received the following report from the engineer in charge, Mr. Moody, of the Delaware Marine Shipbuilding & Engine Co.:

Roach's Shipyard.

The Delaware River Iron Ship Building and Engine Works.

Chester, Pa., Nov. 25, 1905.

Smooth-On Mfg. Co.,
Jersey City, N. J.

My Dear Sirs:

I think we had better keep the 60 pounds of smooth-on.

The little boat left yesterday and is on her route, the boiler has had steam up for several days and the patch put on with your smooth-on works fine so far; not a sign of a leak anywhere.

So far so good.

Yours truly,
THOS. MOONEY.

A Corliss engine cylinder in a large cement works at Bath, Pa., was scored by a broken steel spring ring inside the cylinder 24 x 42, cutting a groove in the cylinder 3-16 inches wide, ¼-inch deep and 42 inches long.

The repair was made as follows: The piston was removed and the groove dovetailed, then it was thoroughly cleaned and dried, and filled with a compound composed of one volume of smooth-on elastic cement, mixed with one volume of smooth-on iron cement No. 1, which makes a stiff putty. This putty was packed into the groove, with a blunt tool, as compactly as possible, until the groove was filled, then it was smoothed even with the curved surface of the cylinder. The exhaust pipe was now closed and steam turned into the cylinder with 110 pounds pressure and held there from 4 p. m. until the next morning at 7 a. m., when the cylinder head was taken off and the cylinder left open to the air for 24 hours. Then the engine was made ready and started up. It has now been running night and day for four months, giving perfect satisfaction. Steam pressure 160 pounds.

The above report was made to us by the engineer who did the work.

The steamship Cusco, running from Valparaiso to New York, had boilers out of commission from leaks in seams and around rivets. This was an inside job and in 24 hours the boilers were repaired and used with 240 pounds steam pressure and they were tight. This is one of many such cases. The chief engineer was so pleased with the use of our cement that he came to our office to tell us about it and to see all the cements we make and learn more about their uses.

A cross compound high pressure cylinder at the 66th street power house of the Edison Electric Light & Power Co., was repaired with smooth-on elastic cement and smooth-on iron cement No. 1—

Diameter of cylinder .. 48 inches, F to G.
Length of crack ...... 16 inches, D to E.
Length of patch ...... 36 inches, H to I.
Boiler pressure .... 150 pounds
Boiler patch .... ½-inch steel plate
Bolts .... ⅝ inch on edge of patch
Bolts .... ¾ inch in the center of patch.

The repair was made as follows:

1. While the cylinder was hot a partial vacuum was created in it and smooth-on elastic cement was painted over the crack. The vacuum drew the cement in and this operation was continued until the crack would take up no more cement.

2. Holes were then drilled and tapped at the end of the crack, D and E, and bolts put in to prevent a further extension of the crack.

3. The patch was cut as represented.

4. The crack was then painted with smooth-on and the patch laid in position. Then it was carefully removed. The imprint of the crack was now shown on the under side of the patch—the smooth-on sticking to it. The patch was then dished along the line of the imprint to make a recess to hold sufficient cement.

5. The plate was then warmed and a compound composed of smooth-on iron cement No. 1 and smooth-on elastic cement, mixed half and half applied to the warm plate with a small trowel, making a thin, even coating.

6. Then the patch was laid in position. The three centre bolts, A, B and C, nearest the crack were brought up (just taut). Then the outside bolts were brought up tight, and lastly, the three centre bolts were brought up as tight as possible, which forced the cement into the crack. Then steam was turned on and the crack was tight.

In these cements there appears a compensation that seems to adapt it to conditions caused by sudden strains and vibrations; for instance, a patch on a steam cylinder of a locomotive, capable of pulling 60 or 70 loaded cars, one of their machines had cracks on the steam way from the piston valve chamber to the steam cylinder on each side of the arch. The cracks had been repaired by patching the old way with white and red lead and iron borings without success. The cracks were then filled with smooth-on cements and are in use now on 200 pounds steam pressure.

There are hundreds of such cases and I believe most of them can be successfully repaired. Don't make your patch plate too thick, fit the edge of plate tight to surface, use plenty of small bolts on edges and a few staggered bolts on each side of middle to force cement into cracks and you will have success.

ACTION OF MARINE BOILER COMPOUND EXPLAINED.

From the earliest days of marine engineering boiler incrustation and boiler corrosion have given an amount of trouble entirely out of proportion to their presence in shore practice.

Up to the early nineties "make up" feed by evaporators was unknown and to this day the evaporator capacity of most ships is so small that they are bound to use more or less salt feed after the fresh water reserves of the double bottom compartments have been exhausted.

Sea water not only contains more scale forming matter than any ordinary fresh water, but the scale formed is much more difficult to remove, as sea water contains a relatively high proportion of the particularly troublesome sulphates and carbonates of magnesia.

The only generally used remedy for incrustations were found in frequent scaling and almost constant blowing off. It will be hard for modern engineers to realize that for many years boiler saturation was not allowed to exceed 2½-32nds resulting in the enormous increase of coal consumption. The adoption of surface condensers brought their additional troubles of grease deposition and electrolytic action, but did not very much reduce the amount of scale formed as salt water continued to be used to make up for the numerous losses of fresh water.

These difficulties were intensified by the exterior corrosive effects due to moisture from the bilge water and to the decomposition of cylinder lubricants as well as irregularity of service, changes in feed water due to constant travel, and a varying coal supply. It is no wonder that engineers sought and are still seeking relief in the use of all manner of chemicals and substances in the hope of increasing the life of the boiler, while incidentally rendering the engineer's life tolerable. Sal soda, caustic soda and potash, eucalyptus, tobacco, potato extract, tan bark, acorns, oak shavings, tallow, vinegar—even acids have been used in the persistent desire to remedy boiler troubles. Today there are hundreds of nostrums on the market under variously attractive names, but generally, with constantly changing consumers. Many of them do "rot" and scale—but rot the underlying iron as well. It is nonsense to say that no chemical should be introduced into boilers except pure water. Yet the experience of engineers with boiler compounds has been so manifoldly unsatisfactory that the above dictum is widely accepted.

One great difficulty with boiler compounds has been that their action is so little understood and rarely examined. Sometimes the compounder makes his combination by mere guess work and trial and error, so that he has no idea of the composition or operation of his medicine. Sometimes it is considered necessary to keep the composition secret. This cause is unfortunately very prevalent—and fully justified by the nature of some compounds.

In the Bird-Archer marine metallic boiler compound the engineer finds a material which, in its working enables him to actually see and understand good causes and reasons why it does prevent the adhesion of scale and grease to the boiler's interior. After the compound has been fed into the boiler for some time it not only causes the previously existing scale to flake off, disintegrate, and fall to the bottom of the boiler as "sludge," but it clothes or covers all of the heating surfaces and parts which are exposed to the water with a firmly adhering, dark, lustrous, enameled coating like a film, but not of a heat resisting nature nor thick enough to in any way retard evaporation.

When any part of the boiler becomes coated with this thin metallic skin deposit it is protected from grease and corrosion. Some chemicals of the compound combine with the matter precipitated from the feed water forming combinations which are either kept in solution in the boiler water until passed out through the bottom blow or fall to the bottoms of water spaces as a very light flucculent powder. Whatever solid deposits do form in the boiler water cannot find lodgement on the heating surfaces because the enamel skin will not allow them to reach the metals to which they could firmly adhere. The presence of this skin also accounts for the prevention of electrolytic action in boilers protected by the Bird-Archer compound. Every beginner in electricity knows that contact surfaces on batteries such as the wire entering the binding post, must be kept bright by scraping. Here a layer of material is interposed between the iron forming one electrode and the copper-brass pipes and valves forming the other element of the boiler "cell," which layer not only prevents contact with the iron but introduces counter electro motive force of its own, reversing and thereby neutralizing the ordinarily formed electrolytic action.

Owing to the distinct action and functions of the several ingredients forming part of this compound, it is able to accomplish widely different objects. Some of the ingredients have the special property of working their way through and under the coat of existing scale, causing it to flake off as if it were pried up and away from the metallic heating surface. Flakes of such scale have been removed in pieces larger than a man's hand. This action is entirely distinct from the scale preventive effect of the chemicals which go into combination with suspended salts to form mud or light powder.

Medicines which claim to cure all ills of the body are generally to be regarded with suspicion. It is because it is widely claimed for this compound that it performs duties apparently so conflicting as the prevention of scale and grease deposit and of electrolytic disintegrations and of boiler corrosion, an understanding of the preserving and protecting qualities of this metallic shield is necessarily to fairly judge the compound's merits. It is clear from its very nature that this coating must preserve its underlying metal from corrosion as the acids or oxidizing reagents which are necessary for pitting are denied access to the iron and must expend their chemical energy on the superimposed protecting crust.

NOT ONE FOR SOUTH AMERICA.

Editor MARINE REVIEW:—The importation of coffee from Brazil into New Orleans and Galveston and the export of cotton from those ports to Europe furnish a basis of communication one way between those two ports and South America, says the commissioner of navigation. Thus during the first six months of 1906, eighteen British and one Belgian steamer entered New Orleans from South America, but not even one steamer cleared for that continent. Some of these steamers proceeded to New York, but the majority cleared for Antwerp and other European ports. Six of these were 12-knot Lamport and Holt steamers of large carrying capacity.

WALTER J. BALLARD.

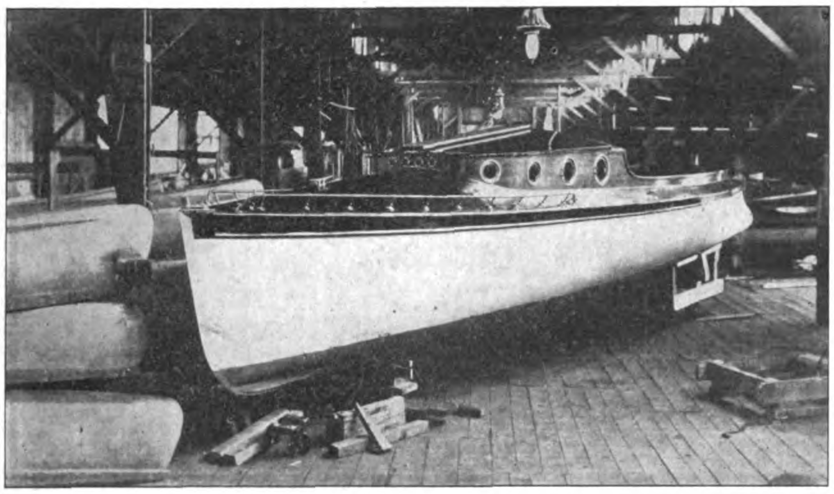
Los Angeles, Cal., Jan. 2.

The government army transport Kilpatrick is now at the yard of the Morse Dry Dock & Repair Co., South Brooklyn, where extensive repairs upon her will be made.

The Fort Wayne Electric Works, Fort Wayne, Ind., have recently issued a series of bulletins and an instructive book setting forth the many advantages of their lighting systems, switchboard panels, etc.

MULLINS 35-FT. LAUNCH.

Two views are shown herewith of a launch built by the W. H. Mullins Co., of Salem, O. This launch is 35 ft. in length with a 7 ft. beam. The motive power consisting of a powerful six-cylinder, four cycle, 60 H. P. automobile engine. The model is a beauty, the lines being carried out gracefully and with a view to obtaining the greatest speed possible. And although this launch is intended primarily as a pleasure craft, it is evident to all who have seen the model, that it is capable of remarkable speed.



35-FT. MULLINS LAUNCH.

The construction of this boat is not only interesting, but impressive to those who have never seen a Mullins' boat in the course of construction. From a full sized clay model, prepared from drawings and designs of one of the most noted designers in the country, are taken plaster casts, which are used as patterns for molding the steel dies by which the plates are pressed. The steel dies are all carefully finished and smoothed up by being filed and polished to a mirror-like finish, placed in powerful drop presses, the heavy plates of 12-lb. gage, galvanized steel, to rigid and lasting form. The gradual pressing of the plates between the smoothly finished dies, eliminating any possibility of the steel being drawn, or weakened at any point. The fact that the manufacturers give a guarantee against puncture is evidence of the durability of this steel hull.

There are but few plates of steel in each hull; consequently few joints. The plates are placed on forms and the joints are countersunk and riveted in the same way the plates of a torpedo boat, battleship, or ocean liner are fastened; then soldered and tested, making the hull practically one piece of strong, smooth steel. A leak is impossible. In fact all of Mullins' boats are guaranteed against leaking.

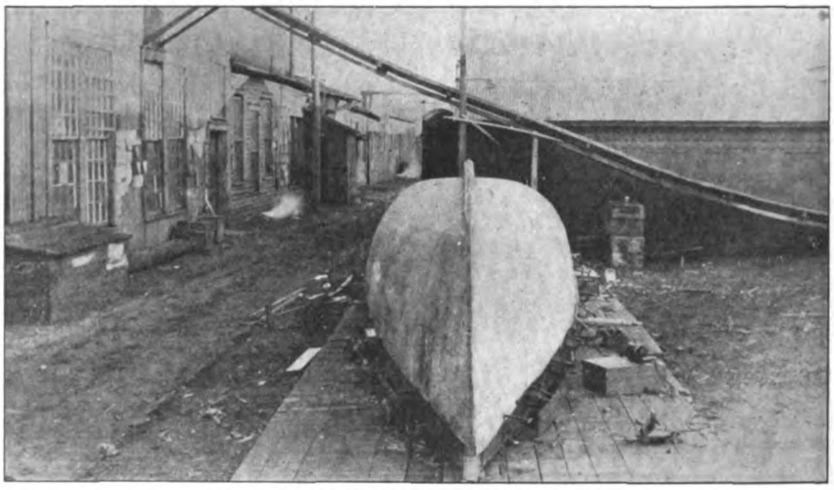
The wooden frame work is of the best selected oak, keel and ribs, steam bent, so as to exactly fit the hull. It is not bulky or heavy, but is extensive and rigid enough to thoroughly strengthen and brace the steel hull. The keel itself is not fastened to the outside of the metal shell by means of bolts as is done in other boats. In the bottom of the steel hull a slot or groove is pressed into which is dropped the heavy oak keel, which is mortised, the ribs passing through the keel, instead of being nailed or screwed to it. The advantage is obvious. It insures a metal covered wood keel, adding the utmost stiffness and one that cannot loosen up, or tear off, causing the hull to leak.

The frame work of the Mullins' boat is attached to the shell only at the keel and at the gunwales. The keel is placed in its position, the gunwales securely bolted in place, the ribs are then forced into position, fitting closely in the shell, bracing and strengthening it, yet unattached to it.

There is not a single nail, screw, rivet or fastening of any kind attaching the hull to the ribs. The result is that there is not an opening in steel shell and if the frame work should ever warp, there are no fastenings of any kind drawn through the shell.

The engine base is attached to the keel and supported by special iron ribs. The vibration or pulsations of the engine are absorbed by the frame work and there being a slight movement possible of the frame work, vibration is not communicated to the hull. There is no danger of opening seams or starting joints and a leak is impossible. As can be seen from this construction, the vibration of the engine cannot in any way effect the seaworthiness of the hull and to any one who has had experience in power boating, the elimination of this serious defect will be thoroughly appreciated. This construction has been patented by the W. H. Mullins Co.

The engine and all machinery are of the concealed type, being placed in a special compartment in the bow, aft of the forward bulkhead. A handsomely paneled oak partition, containing small doors, separates the engine room from the cockpit. The engine is equipped with the Mullins patent, under-water exhaust, insuring noiselessness, and the elimination of all odors, grease and dirt from the engine. The steering wheel and complete control of the engine are within easy reach of the operator's seat and here the motor can be started, as it is not necessary to attach a cranking handle, or in any way come in contact with the grease and dirt of the engine. The absence of all machinery and moving parts in the cockpit is a



35-FT. MULLINS LAUNCH.

feature that favorably impresses every person who has seen this boat, or had experience with the ordinary launch in which the machinery is exposed.

The cockpit is roomy and luxuriously furnished and equipped. Wood work of best selected oak finely paneled, with richly upholstered seats and back rests; floor carpeted; deck trimming, port holes, rails, etc., of the best polished bronze. The equipment throughout is in keeping with the general magnificence of the boat.

This model will be exhibited at all the prominent motor boat shows next season and will without any doubt create a sensation among the enthusiasts.

This company has a handsome catalog which can be had upon request.

OLD-TIME CONDITIONS ON THE LAKES.

"Sailing nowadays is not like it used to be, though the men of today are made out of the same stuff as the old-timers were," declares Capt. John Miller, of Marine City, one of the youngest old tugmen now living on the lakes. "In many ways the conditions are different.

"My first experience was cooking on the little River King, a sidewheeler running between Sarnia and Dresden, Ont I was not much of a cook, but the pastry and bread was bought ashore and I didn't need to worry about that. I did pretty well, but the potatoes would burn once in a while, no matter how careful I was.

"The stove I used was an old-fashioned one with the pipe running into the stack, and the King was a high pressure with an exhaust strong enough for a boat twice her size. It happened that I shipped when she was in port, and I didn't know how the exhaust would act till she got under way.

"Tick, tick, tick! Choo-o-o!

"I was stirring apple sauce at the time and when the exhaust was thrown in the stack, the first thing I knew was sheet of flame and scorching hot air coming out across the legs of my trousers. When I looked down, my trousers were burned in two sections, the fire was out and my apple sauce was gone. I thought sure I'd jump at the end of the route.

"Necessity, the mother of invention, came to my rescue, and I soon got the best of that exhaust. I went out on deck, got three boards and enough zinc to make two metallic appliances to fit over my trousers. I hung them on me by means of my suspenders.

"After that, I used to laugh when the flame would shoot out after the exhaust came down my stove pipe. I fixed the fire so it would'nt go out, and I could cook for hours without feeling the fire."

Capt. Miller knows as much, if not more, about the old days when the river tugs reigned supreme as any living man. He sailed the queen of them all, the Champion, for ten years, and his one ambition was to break all records, including his own. Towing eight or nine schooners through the rivers and lakes was a daily occurrence with him, and getting out of tight scrapes was another. He would plug his boat through seas which made others turn back.

Another of Capt. Miller's experiences was when he left Grummond's employ as captain of the Champion to go on the Sweepstakes for Capt. Pridgeon. Capt. Grummond instructed his captains to watch Miller on Lake Huron and only let him have one tow. Miller was on his way from Buffalo with one schooner at the time.

As Miller tells it, the Grummond tugs Champion and William A. Moore got up on Lake Huron ahead of the Sweepstakes when they were shut in by a fog. The Sweepstakes came along later at a snail's pace, when every once in a while the opposition tugs would toot a fog signal.

"I could tell each whistle," says Miller, "and knew exactly where they were. So I fixed my whistle with spun yarn so it sounded like a fish tug and kept on going for the straits, where I knew it would clear up."

Miller reached the straits and it cleared enough to let him get his eyes on eight schooners laying "heads and tails" to get through.

"When I saw that fleet there," he says, "I knew I would have to get them, so I dropped the one I had and made ready for the eight. I was dead sure of things, because the Champion and Moore were far behind me on Lake Huron."

Miller picked all eight schooners up, but one was Grummond's and in order to give her captain a chance to drop off if he wanted to, he put her on the end. He knew the captain would go on the dock, when Capt. Grummond saw her going down past his office towed by the Sweepstakes.

Capt. Grummond and a thousand and one others in Detroit had money up on his tugs and the Sweepstakes. He felt sure Miller would lose with two of his best boats against him. But when he saw the tow, he is said to have closed up his office for the day.

The Atlantic Works, Inc., 28th St. and Gray's Ferry Road, Philadelphia, Pa., recently received an order from Messrs. Noecker, Rickenbach & Ake, Camden, N. J., for one of their B-17 Bevel Band Saw Machines, which is made especially for ship yard work.

ENGINEERING PROGRESS DURING 1906.

(From the *Shipping Gazette*, London.)

The old year will, of course, stand out in marine engineering as the year of the Parsons' turbine, not so much because it was the period in which the Lusitania and the Mauretania were launched, as because it was the period in which the Dreadnought demonstrated to the world the efficiency of the new engine in its highest development. The success of the battleship proved beyond all doubt the superiority of turbines for high-speed warships. A point was made of the ease with which the vessel was maneuvered. This, it was said, was surprising. Yet it need not have been, because the critics who took this particular line had their first shock of surprise more than a year ago before the Carmania crossed the Mersey Bar for the first time. Her turning trials were the best of the whole series of her trials. It may be taken for granted, therefore, that after the Dreadnought there will be no more large British warships with reciprocating steam engines. Nor are there likely to be many more foreign warships with such engines, because what we choose to do in naval construction is what other nations must do.

OIL FUEL EXCLUSIVELY.

For speedier, lighter craft, of course, the turbine has been out of question the engine for a long time. Its development is higher here, and naval engineers understand it better. They are certainly taking better care of the machinery of destroyers than they did in the Amethyst, for nobody has had to say about any of these boats what Engineer-Lieutenant Ewart said about the cruiser. Still there is plenty of time yet; and, in addition, the newer vessels of the type are much more intricate machines. To date, in the royal navy all the oil fuel that has been used has been sprayed on to coal. In the new destroyers—those placed last, at any rate—oil has to be burned exclusively during the official trials. This may appear to be dangerously experimental; but it really is not. There is a wealth of oil-fuel data at the admiralty, now, and, like every departure of the Fisher regime, there is nothing of the nature of an experiment in it.

NEW TURBINE STEAMERS.

Of mercantile turbine steamers the year has seen some notable examples apart from the express Cunarders, which are, of course, yet to try. The Viper, which the Fairfield Co. built for the Burns' Ardrossan-Belfast daylight

service, and the Great Western Railway steamers St. David, St. Patrick, and St. George, the first and second of which were built at Clydebank, and the third at Birkenhead, are specimens of the turbine cross-Channel boat of high speed. Of less speed, and on that account probably less pronouncedly successful, are the Great Central steamers Marylebone and Immingham. Two ocean-going vessels —the Cunarder Carmania and British India boat Rewa—have fulfilled the promises of their trials in service. It would be idle to deny, however, that the success of turbine boats generally has been alloyed. Some sanguine souls there were who assumed that the Carmania's measured mile performances, for instance, indicated the imminence of a wholesale scrapping of the machinery for making piston engines. If the Parsons' invention had been a miracle, that would have been all right. But it is not a miracle. It is an engine, and in its adaptability to the propulsion of ships its success came to depend on a factor which nobody knew much about. The solution of the marine steam turbine problem depended on the solution of the propeller problem, and practically all the disappointments to date have been due to maladjustments of the two efficiencies. If the turbines were satisfactory the propellers were unsatisfactory, and if the propellers were satisfactory the turbines were unsatisfactory. Incidentally perfection—a working perfection, at any rate—of adjustment is bound to come soon, though we need not shut our eyes to the fact that if more had been known about screws there would have been none of this difficulty. We look to the Lusitania and the Mauretania to let a lot of light in on this problem.

EXPLOSIVE ENGINES.

We still await the turbine cargo steamer of which Mr. Parsons spoke at the Royal Institution early last year. In this vessel turbines were to take up the steam and use it after the reciprocating engine had done with it. This, it is hardly necessary to say, is the direction in which the Parsons' people may most profitably expand their business. With this very field in view, in fact, engineers are striving to get an alternative to the piston engine. There is general realization that the necessity of the day in tramp shipping is cheaper and cheaper boats, and, as a rule, the aim is to devise a propelling installation that will take up less room and be of less weight. Mr. William Beardmore on the Clyde, and Mr. J. E. Thornycroft in the south, are diligently developing producer gas plants. Mr. Yarrow has shown us what is possible with petrol in the 26-knot torpedo-boat which he built experimentally and subsequently sold to the admiralty. What is being done with oil engines was indicated by Mr. Timpson the other night at the Institute of Marine Engineers. Apparently we have exhausted the possibilities of the reciprocating steam engine even with oil fuel, and are on the verge of an important change. We are bound to be, it seems, for the compelling factor of the problem is the need to get the first costs and the working costs of cargo steamers down.

A DETERRENT TO PROGRESS.

It is one thing, of course, to see this need and to set it down as clamant, and quite another to set out to meet it. A fact too easily forgotten is that there are millions sterling fixed in engineering plant and machinery in Great Britain today. To assume that this need not necessarily impose a barrier to engineering progress is to assume too much. A great deal of the original opposition to the Parsons' turbine had its base in the knowledge that the success of the turbine would scrap hundreds of thousands of pounds worth of machinery. Ultimately it was said that much of the existing machinery could be easily and cheaply adapted to the manufacture of turbines. Judging, however, from the fine new tools which Mr. Laing has had installed at Wallsend, the existing machinery has not been easily adaptable to the manufacture of turbines of the largest size. The fact seems to be that if Mr. Parsons had not been backed to begin with by influential people—the Dennys, for instance—he might still have been knocking at the outer gate of engineering with his marine turbine. Yet the changes necessitated by the turbine are nothing to what would be imposed by the producer gas plant, or the oil engine, or the petrol motor. The perfecter, therefore, of an efficient gas plant, or a good oil engine, or a safe petrol motor, may be prepared for storms of criticism to which the original criticism of the turbine was but a zephyr or two in a particularly fine summer. Curious it is, still true, that this ship building wealth which exists on the cheapening of cargo steamers should be bound to resist every cheapening movement from another direction.

PERSONAL.

Mr. J. F. W. Bunsen has entered the employ of Muralt & Co., engineers and contractors, New York, and will take charge of their southern office in Charleston, S. C. Mr. Bunsen, who is a nephew of the late Prof. Bunsen, the inventor of the burner which bears his name, has had many years experience in designing and erecting important engineering works. At the time of the Galveston flood Mr. Bunsen was engaged as the mechanical superintendent of the American Cotton Co., southern district. He was delegated by the city of Galveston to prepare the designs and plans for a system of breakwaters and although his plans were not immediately utilized on account of lack of funds, the present admirable breakwater system has been built practically in accordance with his original ideas and plans. His experience also includes the design and erection of various breweries, sugar refineries, spinning mills and electric light and power plants, including oil refineries for the Standard Oil Co. in Mexico and South America, cotton mills for the American Cotton Co., and various sugar plants in Cuba, Mexico and South America. Mr. Bunsen will have charge of Muralt & Co.'s various projects in the southern states and especially the large power plant which that company is now building for the United States government at the Charleston navy yard.

MARINE PATENTS.

846,567. Buoy, Torpedo and Similar Device. Warren E. Hill, New York, N. Y., assignor to Thomas F. Rowland, New York, N. Y.

846,736. Submarine Torpedo-Boat. Alfred Elgar, North Brixton, England.

846,770. Life-Boat Launching Means. Richard Zolling, Oakland, Cal.

847,112. Boat Plug. George W. Renton, Brooklyn, N. Y.

847,222. Propeller. Alonzo L. Ames and Byron S. Ames, Newberry, Pa.

845,623. Means of Escape from Sunken Submarines. Ernest A. Edney, Horndean, England.

845,659. Automatic Propelling Life Preserver. William Luce, Seaside, Ore.

REAR ADMIRAL CHARLES W. RAE
Chief of the Bureau of Steam Engineering, Navy Department

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